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THE MIGRATION OF STUDENTS[1]

A PLEA FOR THE INDIVIDUAL IN EDUCATION

THE chairman of our judicial council, Dr. Means, in a recent address on "The Relations of the Medical Colleges in the Matter of the Migration of Students," has stated that these relations should be adjusted on the basis of the Golden Rule. With this I heartily agree. I would, however, call attention to the wording of the Golden Rule, "Do unto others." This seems to imply that our relationships are multiple rather than duplex.

There is hardly a problem in ethics to be settled on the basis of "Thou" and "I" alone. No case of migrating students should be considered from the standpoint of the colleges alone. In every instance the public or state has a claim on our consideration, for we are the servants of the state in the making of physicians.

We are also in a peculiar and intimate degree responsible to the student himself. We take his money; we take what is more valuable than money, his time. We modify his whole life. To take out the human element from our work; to claim that the student acts always of his own free will; to make our colleges by inflexible rules mere mechanisms for grinding out as doc-

[1] Read before the Association of American Medical Colleges, March 1, 1912. Readers of this paper should bear in mind the legal restrictions on medical educational institutions, which other departments of education are not subject to. These cover such topics as length and number of yearly sessions required for graduation, admission, advanced standing, credit from other institutions, etc. It should also be noted that medical schools have on their faculties numerous professors who are primarily in medical practise and only incidentally acting as teachers.

tors those individuals alone who can fit the hoppers and cogs of the machine—to do these things is to take away all proper significance from education.

The more I consider it the more I am convinced that our personal duty to the individual student is our fundamental duty. If we can do right by the individual student, we shall do right to the other colleges and to the state. If we do right by the individual student, we shall see that his obligations are met; that his deficiencies are made good; that he is protected from his own misdirected inclinations; that he is kept, if need be, from a profession for which he is not fitted. I propose, therefore, to discuss the subject assigned to me from the standpoint of the individual student.

I would strongly emphasize that my argument is not to favor lower standards. The poor-boy story and the easy pathways to practise do not appeal to me. Any one who draws from my expressions regarding the rôle of rules and regulations the conclusion that I favor the removal of the safeguards to medical practise wilfully reads into them what is not there. On the contrary, I believe that the efficient judgment of the individual case, whether by entrance examiner or faculty or state board or all three of these, would constitute the best possible safeguard and one which ought to be added to the regulations and examinations, which at present constitute the chief protection against the inefficient and unprepared.

Strictly speaking, there is no such thing as equality. Variation holds everywhere in the social world, as it does in the animal and plant world. Every case is an individual case. Education will reach its highest when it becomes individual.

The individual student is not the student *en masse* nor the average student. The individual student means individual consideration. He means the breaking loose from rules and the consideration of pertinent facts. He means the application of principles rather than formulas. He is a difficult problem not to be solved by engineering handbook nor plotted in two dimensions.

I am provoked just here to the further platitude that we have in our political and social life, as in education, too many rules, too many laws, regulations, prohibitions. (I suppose this is because we are so infernally human that we can not be trusted to apply the Golden Rule, which our chairman rightly considers our standard.) At the same time that we are burdened with laws we have no adequate mechanism for securing justice to the individual. This is true in every relation of life.

Let us glance for a moment at the legal restrictions placed upon medical education. The law compels every man who desires to enter the medical profession to attend four sessions in a medical school. It takes no cognizance of the fact, recognized, I am sure, by every man here, that some men would be competent in three years, more competent, in fact, than others in thirty years.

The law provides that the four sessions shall be in four separate calendar years and disregards the fact that some students could work to advantage eleven or twelve instead of eight or nine months in a year. Why should the law permit the doctor to practise twelve months in a year but allow him to study only eight or nine?

The laws[2] do not permit that any time credit be given for attendance in a college of arts or science, yet in particular cases the work done there is better than that of some medical schools.

[2] True of most states. The laws of a few states still permit graduates in arts or science to obtain the M.D. in three years.

Now, I am not arguing that these laws are bad. Some of them are undoubtedly artificial. But even these have probably been necessary as applied to average students and average colleges. The trouble is that no arrangement is provided by which the particular case can be excepted. The law, we are told, is no respecter of persons. So much the worse, I retort, for the law. And the law by the way is beginning to recognize this fact, as witness the more enlightened way in which it is beginning to deal with juvenile offenders. Each case is settled on its merits and by careful judgment of experts.

In our association also we have laws. With much labor we have formulated a curriculum from which no college can deviate in any particular more than 20 per cent. Yet to-day I have in my laboratory a young man who shows talent as an investigator. He desires to become and I am sure will become a professional physiologist or pharmacologist. I should be a traitor to my science if I compelled or advised that young man to take the straight, fixed curriculum. He should have a special course laid out to meet his special needs.

But some one objects, "This is unsafe; this young man may later go into practise." My critic is laboring under the belief that our fixed curriculum contains all the subjects and only the subjects without which one can not safely go out as a physician. My answer is, I know the man and his ability. The curriculum, I may further remind my critic, is literally a race course. We do not use the same kind of track for automobiles and aeroplanes and steam yachts.

This criticism and my answer to it lead me to state the first condition for dealing properly with the individual student, whether as regards curriculum, migration or any other matter. *Some one has got to know that student and the facts about him.*

A second critic may have said to himself when I suggested a special curriculum for my student in physiology, "It will be against the Constitution of the Association." My reply is, in the famous words of the practical statesman, "What is the constitution among friends?"

And that leads me to enunciate the second condition for dealing with the individual student. *There must be a body of friends, friends of the student, friends of education, friends of the public, who shall determine when, where and how the constitution (i. e., the rules and regulations) may safely be broken.*

You catch the drift of my thought: a college may be run in two ways. It may be run by inflexible rule. Students are received, classified, advanced, rejected, graduated, by regulation and statute. All that comes in, whether iron, steel, lead, copper, brass, silver or gold, is drawn through the same hole to wire of the same size. Such a college is not a human being. It is a machine, and it makes no mistakes. It needs no intelligent supervision. You just start the wheels going and watch the rollers turn merrily on.

Or a college may be run for the individual. It may have small regard for paper standards, have few regulations, have a flexible curriculum, care little for classification, permit specialization. It may make wire of iron and steel. It may turn the lead over to the plumbing industry. It may make scientific apparatus of its copper and brass. It will surely make jewels of its silver and its gold. Such a college is human. It makes judgments, choices, designs. It is not a machine, and it makes mistakes. It can only avoid making many mistakes by the most intelligent supervision and the combined judgment of experts.

If I may change my figure of speech, the rules, regulations, precedents and formulas for running a school correspond to the reflex mechanism in an animal. They adjust it well to the average conditions of environment and govern certain subordinate functions. But the animal which is purely reflex stands low in the scale. And so does the college that runs by rule and formula. What is needed in the animal is a superposed cerebrum, which can inhibit reflexes and regulate behavior in accord with a greater complexity and continuity of stimuli. Speaking as a man of the street—and not as a scientist nor as a theologian—what the animal needs is a soul. And that is just what the college needs. The soul of the college should be such an organization of experts as can exercise safe and sane judgment under varying conditions. This paper will be concerned, first, with the organization of such a body of experts; secondly, with the methods to be used by them in taking care of migrating students.

Regarding the first topic, organization, I believe that it is unsafe to leave to the dean alone the decision of important matters relative to the individual student. The dean even in the case where he devotes a large share of time to his office can not know the work of the student in all departments. He may, it is true, have the record of grades, but these are not the intimate personal data on which the individual case must be settled. The grades constitute a part of the regular reflex machinery which disposes very well of the average student. They are of value, but should not be the sole criterion for deciding questions regarding particular students.

Another reason why the important individual case can not be left to the dean is that he is almost always a professor, and looks with the usual jealous but magnifying eye on the importance of his own department. The individual student must be considered from all sides.

If the dean can not dispose properly of the individual student, much less can a secretary or registrar, who is usually not an educational officer in the proper sense, but strictly a part of the reflex machinery.

The individual student, furthermore, can not be considered properly by the faculty. This is not easily done in a school of arts or science, and is even less feasible in the average medical school, where many of the professors are in medical practise and give only a portion of their thought to educational problems. The word of a clinical professor lecturing one or two hours a week is of less value as regards an individual student than that of a paid assistant who meets the student daily in the laboratory. Moreover, faculties meet infrequently, and the individual case needs immediate consideration and action.

A committee of the faculty, provided it has power to act, can do the work better than the faculty, but here again there are objections. The faculty usually consists only of professors, and a large proportion of them do not come into intimate contact with the students. The committee is likely to partake of the same character and often degenerates to one man control.

Finally the case of the individual student should not be referred piecemeal to the individual department heads. Take the case of a migrating student, for example. If he is sent in turn to the professors of chemistry, anatomy, etc., each settles his part of the case without reference to the others. One exaggerates the value of his own teaching and will give no credit for work done in another laboratory. Another is too lenient or does not wish to be bothered. Conditions are imposed without regard to general time schedule, and no consideration is given to the char-

acter and needs of the particular student.

The case of the individual student should be referred and the power to break rules and precedents should be given to those who by training in educational methods and experience with students know the individual case and what may safely be done. These are essentially the paid, full-time instructors, with such few others, perhaps, as have demonstrated that they are pedagogues as well as practitioners. The full-time instructors are educators, not physicians. They are paid to do work of the kind we are considering as part of their "teaching." They can be called together frequently.

In the school that I represent the paid teachers (with the addition of four heads of clinical departments) constitute the council. All paid teachers except student assistants are included. This council has full power to settle all questions relative to students. The remainder of this paper will be chiefly concerned with the methods by which the council disposes of migrating students.

In presenting the work of our Council I would particularly disclaim a new discovery in education. Somewhat similar methods are used elsewhere. Nor would I claim that our organization in its exact form should be generally adopted. Each school must work out that form of government which best suits its environment. I use my illustrations from my own experience not because they are noteworthy or unique, but because they constitute my store of available facts.

Taking up now the specific topic of discussion, migrating students may be classified as follows:

1. Good students who come from "good" schools.

2. Poor and doubtful students who come from "good" schools.

3. Students who come from "poor" schools.

(By "good" school, I add parenthetically, is meant a school which one considers as good as or better than the particular school one individually happens to represent! I consider Western Reserve a good school. My friend Waite considers St. Louis University a poor school. I pass on the compliment by considering certain nameless institutions poor schools. The point is that in this matter of migrating students the American Medical Association classification is of little value.)

Referring to my first class of migrating students, it is a lamentable fact that few good students come from good schools. The migration of students for the sake of coming under different environment, varying methods and special professors, so common in German universities, is almost unknown in America. This type of migration has always been discouraged by the colleges, and the fixed curricula have not facilitated it.

A few good students change colleges for reasons unconnected with education. A few change on account of legitimate personal grievances. (I can not agree with Dr. Means, who states that he has never known such a case. On the whole, however, we will all agree that tales of personal grievance are to be taken in homeopathic doses, with plenty of water.) Whatever be their reason for changing, provided it is honorable, the good students who come from good schools should be accepted on the basis of equivalence of discipline, rather than exact equality of subject matter. If the student, let us say, has had 600 hours of anatomy and 500 hours of physiology, whereas your curriculum requires 1,000 hours of anatomy (heaven save you!), and only 300 hours of physiology (heaven save you again!), it is neither necessary nor

just to condition the student in anatomy. If you are satisfied that the teaching is good and thorough in the other school, you can overlook differences of this kind. Of course if some important subject has been omitted on account of difference of curriculum, it must be made up. On the whole, the good student should slip in easily on his record.

Allow me to introduce here a paragraph on the general subject of migration of good students. I believe it should be encouraged. If we could implant the idea that the goal of the student's desire should be thorough knowledge of anatomy, of physiology, of medicine, and not the possession of a certain piece of sheepskin, we should be on the way to better things. And if to the student specially interested in physiology I should say: "Professor Blank is one of our best physiologists; why don't you take a year with him?" I should be giving scope to that student's interest and broadening my science at the same time. If we proceeded in this way, the time might come when students would select men instead of schools. And when that time comes, a professorship will be worth working for and worth working to keep, having been attained. When those good days arrive, we shall not find it so difficult, perhaps, to find men willing to enter the laboratory sciences as a career. But whether these good results follow or not, I believe that the migration of students should be encouraged from the standpoint of breadth of culture and training. And our purely American whoop-it-up notion of "college spirit" and school loyalty should be somewhat abated in favor of a better ideal.

Taking up the second class of migrating students, the poor students from good schools, we have our most difficult proposition. When a man with a poor record comes from Washington University or Michigan or Missouri, I have chills. And when he tells me he comes because of our superior facilities, I have an internal spasm. Such a man may have a "good constitution." He may "recover," but the prognosis should be "guarded." The council of our school has, therefore, found it necessary to decline to receive such students into our senior class. The reason is based on my first principle enunciated above. We must know the student, and we can not do that in the senior year.

A second provision is that much of the credit allowed is contingent. For example, histology may be credited, provided the student makes a good grade in pathology; or credit in dissection may be made contingent on topographical anatomy. We believe this arrangement is logical, and it certainly has a good effect on the student.

If the student has a failure from his former school, he is obliged to take further work in that subject. But we have no hard and fast rule about repeating laboratory courses. Too much repetition of elementary work is discouraging. Short special courses are better; and we have frequently organized such courses, primarily for the third class of migrating students, but to the great advantage also of the second class.

Even if the student is to be classed as a junior, we always hold him for one intensive laboratory course, commonly topographical anatomy (cross sections), which is a hobby of ours and on which we have a taskmaster not to be evaded, tricked or cajoled.

We find our summer school of great value in whipping delinquents into line. This is true both of our own backward students and of those who come from other colleges.

Taken all in all, the second class of migrants are not altogether a discouraging body of men. Frequently they see the

error of their ways and settle down to business. Sometimes discouragement in one environment is followed by a better spirit under new conditions. The mentally deficient, the ill prepared, the congenitally slothful, the habitually dissipated, must of course be dropped. Our primary idea is to keep the student long enough under the close supervision of the paid instructors to know whether these qualities were the cause of the original failure.

The third class of migrating students includes those who come from poorer colleges. Mr. Flexner has discussed these in some detail. He shows how a student who originally could not enter a college may eventually come in with advanced standing through attendance in one or more inferior institutions. The student thus evades the rules of entrance of the first school. This seems deplorable and is certainly unfair to the other students who were obliged to come up to the standard of preparation before entering their freshman year. And for the particular condition that Mr. Flexner discusses, there is only one proper procedure, and that is to enforce the same rules of preliminary education on students who enter with advanced standing as on those who enter the freshman year. I shall say nothing further on this point.

On the other hand the assumption that a student from an inferior school is himself necessarily inferior is absolutely wrong. In fact, my experience is that such a student is generally a very good man who desires to better his condition. And in contrast to the heart failure with which I meet the incoming migrant from Michigan, might be mentioned the welcome accorded the students from several nameless institutions.

Now, how should such a student, as an individual, be dealt with in justice to himself, to the college and to the public? As to the public, it is plain that the student should not be graduated till he is competent. As to the college, it is evidently bad policy (to put it narrowly) to graduate him before he is safe. As to the student, he has put in his time in the inferior school and has presumably gathered something. To refuse all subject credit and make him repeat all the previous work arouses revolt, and in my opinion is unjust. To refuse or diminish time credit beyond what is needed to know the student and his capabilities is also wrong. Time is not money, gentlemen. Time is life, and not to be handled carelessly; not to be required of the student as from inexhaustible store, but rather as that which not enriches us but makes him poor indeed.

I shall be obliged to discuss this class of students, as previous ones, from the standpoint of my own experience. The student is brought before the council; his credentials and grades are presented; he is questioned as to the nature of his previous work; and the decision, which is always a tentative one, is based not upon fixed rules, but upon careful consideration of that case.

The principle of contingent credit is frequently applied. For example, credit in dissection, if he passes in topographic anatomy. This procedure is safe, and it is sound pedagogically.

The principle of additional required laboratory work is applied, particularly by demanding attendance in summer school or on short special courses.

The principle of examination is applied, but not universally. For example, I frequently credit a student in freshman physiology if he passes on the sophomore work, although the topics considered in the two courses are different. I think I can discover whether he can think physio-

logically as well from one part of the subject as another.

The principle of requiring a sufficient attendance to give us knowledge of the student is insisted on. No student from an inferior college is received into the senior year.

To the furtherance of our knowledge of the student's ability as a laboratory worker, we always require at least one complete laboratory course, even if the student is admitted to the junior year.

On the other hand, we are not particular that every course which the student has had shall be of the same length, character and strength as our own. If he has had a fair course in bacteriology, but not so good as ours, I am willing to give him credit and let him take instead an intensive course in, let us say, pharmacology. Our idea is equivalent discipline, not parallelism of curricula.

That the students from poor schools have usually succeeded is shown by our experience during the past five years. The leader in our present senior class is a student who came into our junior class last year from a school which would be unrecognized by many members of this association. Of course, some have fallen by the way, and either voluntarily withdrawn or been dropped by the council.

There are a few more self-evident propositions to be considered. For example, the school from which the student comes should be conferred with. Not only should the grades of the student be asked for, but all facts concerning him which will assist in properly disposing of his case. That all obligations to the first institution, including the payment of fees, should be satisfied, is a clear demand on the student as an honorable man, seeking to enter a gentleman's profession. We should refuse him unless he meets such obligations.

There are certain institutions, on the other hand, which refuse to respond to requests for grades or information regarding students who wish to enter another school. I hold that such students may properly be received on their class grades or attendance certificates only.

In the enjoyable correspondence which I have had with Dr. Means in regard to this paper, he has raised several specific questions of interest. "For instance," he says, "a student applied for admission to the Starling-Ohio last fall with credentials of having completed his sophomore year and wanted junior standing. The card showed six or seven conditions on regular examinations, and that they had been removed by subsequent examinations—three or four subjects requiring two efforts. I could not have given him," continues Dr. Means's letter, "more than sophomore standing, which he refused to accept and returned to his old college."

This is one of my heart-failure cases. I believe the best way would be to refuse the student altogether. But we have never reached that stage yet. Our council would probably have allowed the student two years' time credit, but we would have loaded him up with conditions and summer-school work enough to test him pretty thoroughly. Dr. Means's even more drastic action is commendable. One thing is certain; if you grant these students full junior standing, you will suffer for it. You can not catch these migratory birds in the junior and senior years. The cages are too full of holes.

This case brings up another topic, that of giving students passing grades on condition that they go to some other school. This is a despicable practise. Some schools not only pass on their lemons to other institutions, but give them certificates as oranges. We ought to swear by the shade

of Hippocrates never to be guilty of that injustice—for injustice it is to the student, to both colleges and to the public.

Another experience is that which Dr. Dodson and I so frequently had at Rush Medical College ten years ago. A certain university gave only the final standing of the migrating student, without stating that he had been conditioned or failed and subsequently passed. It did not give numerical grades, but merely said "passed." We were led to suppose that such men were all right, whereas they had been weak students with repeated deficiencies. It was only after much disastrous experience that we learned the truth. In St. Louis I had similar experience with schools which gave credentials indicating the final standing but not the intermediate deficiencies of students. This practise seems to accord with the gold-plated rule, "Do others." The credentials should show every condition and failure, whether removed or not. Every important faculty action should also be set down, such as required repetitions, demanded withdrawals, etc.

Should the receiving school be governed in its treatment of a student by the advice of the school from which he comes? Theoretically we may answer "yes." But in my experience, the latter institution, as a rule, has little advice to give. It is usually glad to get rid of the man and does not care what becomes of him. There are, of course, exceptions; and in such cases the credentials and correspondence should be of great weight in deciding the action of the receiving institution. On the other hand, standards and methods vary; and I do not think a college has necessarily just cause for complaint if its emigrating student is received on different terms from those which it would itself impose on him.

An interesting case somewhat under this category has occupied the attention of Dr. Barlow, Dr. Means and myself this year. A student spent three years at the Los Angeles Division, University of California. He passed with good grades in all except three minor subjects. In these branches he failed to attend 80 per cent. of the exercises, as required by the college and the California statute. The faculty, therefore, ordered that he repeat the junior year.

This student came to St. Louis, giving as his reason the fact that we have a summer school, and that he desired to make up his time deficiency by attending a summer session. In addition to credentials and letters establishing the above facts, he presented letters from the instructors in the branches mentioned, stating that he had done the work and had passed the examinations, but that these were not allowed to stand on account of deficiency in time requirements, as previously stated.

Our council went over the case and voted that he should be admitted as a conditioned senior, with the understanding that he should take a summer course and, if all his work proved satisfactory, should be graduated at the close of the summer school. It was further provided that this action should be contingent on its approval by the dean of the Los Angeles Division, University of California.

I submitted the action to Dr. Barlow. He submitted it to the California Board and the board submitted it to the chairman of the Judicial Council of this association. As a result our action was not approved, and we were obliged to classify the student as a junior.

Now I have nothing to say as to the disapproval of our action. I have no doubt the disapproval was founded on the state law and could not be avoided. What I do maintain is that so far as the good of that student was concerned, our action was justified by all the circumstances; and if

there were any national body, similar to our school council, clothed with power to consider the individual case and settle it on its merits, this young man would probably have been saved one year of valuable time.

It is of course easy to answer that the man knew the rule and should have governed his attendance accordingly. But from my point of view the rule is a device for securing proficiency. As a general thing it promotes proficiency and is therefore a good rule. But in this case it was not necessary, as the documents show. Justice to the individual, therefore, made it desirable that the rule be not enforced. You say this would create a bad precedent. I answer it would create a good precedent that, for good reasons, exception may be taken even to a good rule.

Dr. Means has asked me to comment also on the action of the instructors who gave the young man statements of having passed their courses subject to the time requirement above mentioned. As I do not know the conditions at the Los Angeles school, I think it would be unfair to express a specific opinion. In general it may, perhaps, be claimed as the just prerogative of an instructor to give to any student a statement of the work he has done and the proficiency attained while studying under that instructor. For administrative reasons, in schools hemmed in by legal restrictions like our medical schools, it is well that this prerogative be exercised with caution. In our school it is a matter of custom that no grades be given out by the instructors. If any chose to do so, I should not complain. But it is clear that a grade so given does not constitute school credit, for that depends on other factors, such as registration, payment of fees and legal attendance.

SUMMARY

Migrating students have been divided into three classes. The good students who come from good schools should be accepted on the general principle of equivalence of discipline rather than exact parallelism of courses of study. Migration of this kind of students should be encouraged. Poor students from good schools, what Dr. Means calls "lame ducks," need very careful consideration and supervision. Their standing should be provisional and contingent on good work. Each case should be considered on its merits, and the student given a fair opportunity to redeem his record. But he must be held rigidly enough to test his ability and knowledge. It is not wise to take such students into the senior year.

The third class consists of students from inferior schools. It can not be ascertained in advance whether they are capable or not, as the grades from many of these schools are of no value. These students likewise should not be taken into the senior year, but by two years of selected work, supplemented in many cases by summer school, many of them can be graduated on a par with the regular members of a class. These students are usually men who made a mistake in their original choice of a school and who are earnestly desirous of bettering their condition. Each student must be considered individually, and his credits and studies adjusted to meet his personal needs. Hard and fast rules can not be followed, but certain principles find more or less general application. These are considered in the body of this paper.

For the adequate consideration of the individual student, whether in the matter of migration or any other phase of school life, a body of trained educators must be constituted with ample powers. It is recommended that this body be composed primarily of the paid, full-time instructors. In most medical schools this would not be too large a number to be effective. This

body should be free to use its judgment for the best interests of the individual student. Rules and precedents have their value for the regular progress of the student body, but must be considered a means and not an end. Justice to the individual is our fundamental duty. Broadly considered, just action for the individual carries with it justice to the other schools and to the public. We must beware lest in our blindness and in our sloth and in our preoccupation we bow down to the wood and stone of rules and regulations. Let us set up rather the god of individual education, which is a spirit and not a formula; the spirit which so successfully wrought in medical education in the days of preceptor and student; the spirit which has produced such apparent prodigies as Carl Witte and young Sidis; the spirit which makes an educational institution, not a machine nor a purely reflex organism, but a human entity with a human soul.

E. P. LYON

THE GEOGRAPHICAL DISTRIBUTION OF THE STUDENT BODY AT A NUMBER OF UNIVERSITIES AND COLLEGES

THE accompanying table explains the geographical distribution of the student body of twenty-four American universities, five New England colleges for men, five colleges for women, one eastern and one western school of technology and one Pennsylvania college and engineering school, for the academic year 1910–11, the summer session students being omitted in every instance. The corresponding figures for 1909–10 were not compiled; those for 1908–9 may be consulted in the issue of SCIENCE for October 1, 1909, those for 1907–8 in the issue for October 30, 1908, those for 1906–7 in the issue for July 26, 1907, and those for 1904–5 in the issue for October 6, 1905. To the table for 1909–10 have been added the University of Syracuse, the University of Texas and Washington University, St. Louis.

Comparing the attendance by divisions of six eastern universities (*Columbia, Cornell, Harvard, Pennsylvania, Princeton, Yale*) with the corresponding figures for the same universities in 1908–9, we note that there has been a gain for these universities, taken as a whole, in every division, the largest increase in the actual number of students, leaving the North Atlantic division—in which all of these six universities are located—out of consideration, having been recorded in the North Central division, where there has been a gain of 310 students. The South Atlantic division comes next, with an increase of 126 students, followed by the Western division with a gain of 117 students, the South Central with 89, foreign countries with 27 and insular and non-contiguous territories with 23. The total increase in divisions outside of the North Atlantic in the two years under comparison is 692, as against a total increase of 527 in 1908–9 over 1906–7. Calculated on a percentage basis, the total gain of the six universities in the North Atlantic division between 1909 and 1911 amounted to 11.6 per cent., as against a gain of 13.3 per cent. outside of the division mentioned. In 1908–9 the percentage of increase in the North Atlantic division over 1906–7 was 7.6 per cent., as against a gain of 11.4 per cent. in the other divisions combined. In the North Atlantic, South Atlantic and North Central divisions and in the insular and non-contiguous territories all of the six universities with the exception of *Yale* show an increase in 1911 over 1909; in the South Central division all of the six institutions have made gains, in the Western division all show an increase except *Princeton*, while in foreign countries all have

experienced gains except *Pennsylvania.* Comparing the figures for 1910–11 with those for 1904–5, we observe that the most substantial gains have been made by *Pennsylvania* (96), *Columbia* (92) and *Cornell* (63), in the South Atlantic division; by *Columbia* (61), in the South Central division; by *Columbia* (252), *Cornell* (175), *Harvard* (132) and *Pennsylvania* (64) in the North Central division; by *Harvard* (60) and *Yale* (52) in the Western division; and by *Pennsylvania* (79), *Columbia* (74), *Cornell* (61) and *Harvard* (60) in foreign countries.

Of the western universities, *Michigan* has by far the strongest hold on the North Atlantic division, attracting 638 students (as against 394 in 1905), to *Wisconsin's* 96, *Ohio's* 86, *Illinois's* 76 (36 in 1905), *Northwestern's* 64, *Stanford's* 49 and *California's* 34. Of the universities *Harvard* leads in all of the New England states with the exception of Connecticut, where *Yale* has the largest following, and of Vermont, where *Syracuse* is in the lead. *Columbia* naturally has a considerable lead in New York and New Jersey, while *Pennsylvania* of course leads in its own state. In New York *Columbia* is followed by *Syracuse, Cornell, Yale, Harvard, Michigan, Princeton, Pennsylvania.* In New Jersey *Columbia* is followed by *Pennsylvania, Princeton, Cornell, Yale, Harvard, Syracuse.* In Pennsylvania the University of *Pennsylvania* is followed by *Cornell, Princeton, Yale, Harvard, Columbia, Michigan, Syracuse.*

Examining next the attendance of the group of male colleges and technical schools, we note that the order for the North Atlantic division is *Massachusetts Institute of Technology, Dartmouth, Lehigh, Williams, Amherst, Wesleyan, Bowdoin, Purdue. Wesleyan* naturally leads in Connecticut, *Bowdoin* in Maine, *Massachusetts Institute of Technology* in Massachusetts, *Dartmouth* in New Hampshire and Vermont and *Lehigh* in New Jersey and Pennsylvania. *Williams* leads in New York state and *Massachusetts Institute of Technology* in Rhode Island. 27 per cent. of the students at *Amherst,* as against 43 per cent. in 1906, have their permanent home in Massachusetts; *Bowdoin* attracts 74 per cent. of its student body from Maine, as against 77 per cent. in 1908; 27 per cent. of *Dartmouth's* students, as against 21 per cent. in 1906, hail from New Hampshire and Vermont; the *Massachusetts Institute of Technology* attracts 56 per cent. of its student body from Massachusetts, as against 55 per cent. in 1908; 20 per cent. of *Wesleyan's* students, as against 35 per cent. in 1908, claim Connecticut as their permanent home, while *Williams* enrolls 22 per cent. of its student body from Massachusetts. The latter institution attracts almost twice as many students from New York as from Massachusetts; *Amherst* also attracts more students from the Empire state than from Massachusetts, and *Dartmouth* attracts almost twice as many from Massachusetts as from New Hampshire. 56 per cent. of *Lehigh's* student body hail from Pennsylvania, as against 60 per cent. in 1906, while 76 per cent. of *Purdue's* students claim Indiana as their permanent residence, this figure having remained stationary since 1908.

Of the eastern universities, *Syracuse* possesses the largest percentage of enrollment from its own state, namely, 86 per cent; it is followed by *Pennsylvania* with an enrollment of 67 per cent. from its own state, the same as in 1906. *Columbia's* percentage of New York students has dropped from 66 per cent. in 1906 to 62 per cent. in 1911; *Virginia* attracts 57 per cent. of its clientele from its own state, as

against 53 per cent. in 1908; *Cornell's* percentage of New York students has dropped from 56 per cent. in 1906 to 55 per cent. in 1911; of *Harvard's* students 50 per cent., as against 54 per cent. in 1906, are residents of Massachusetts; of the students of *Johns Hopkins* 41 per cent. are residents of Maryland, as against 43 per cent. in 1909; of *Yale's* students 35 per cent., as against 33 per cent. in 1906, have their home in Connecticut; and of *Princeton's* student body only 21 per cent., as against 20 per cent. in 1906, are residents of the state of New Jersey.

Coming to the South Atlantic division and taking into consideration only the six eastern universities mentioned in the beginning of the article, we note that the order is *Pennsylvania, Cornell, Columbia, Harvard, Princeton* and *Yale—Pennsylvania* and *Cornell,* and *Princeton* and *Yale* having changed places since 1905. Of the remaining eastern universities *Virginia* and *Johns Hopkins* naturally have the largest following in this division, while of the western institutions only *Michigan* makes a good showing here. Of the colleges *Lehigh* has the best representation, its main strength lying in Maryland. As for the standing in individual states, *Pennsylvania* naturally leads in Delaware and *Johns Hopkins* in Maryland; *Cornell* leads in the District of Columbia, *Pennsylvania* in Florida and North Carolina, *Columbia* in Georgia and South Carolina and *Ohio State* in West Virginia. *Princeton* is second in Delaware, *Cornell* in Maryland and *Johns Hopkins* in Virginia.

In the South Central division *Texas* naturally heads the list, followed by *Columbia* (133, as against 72 in 1905), *Virginia* (127), *Harvard* (113–88), *Michigan* (97–64), *Cornell* (91–76), *Yale* (90–80) and *Missouri. Purdue, Massachusetts Institute of Technology* and *Wellesley* draw over 30 students each from this division. The largest representation from individual states is found at the following universities. Alabama: *Columbia, Harvard* and *Virginia;* Arkansas: *Missouri, Northwestern;* Kentucky: *Michigan, Harvard* and *Princeton* and *Yale;* Louisiana: *Virginia, Cornell* and *Johns Hopkins;* Mississippi: *Columbia, Virginia;* Oklahoma: *Missouri, Kansas, Michigan;* Tennessee: *Columbia, Cornell* and *Virginia;* and Texas: *Texas, Virginia, Columbia* and *Harvard* and *Yale.*

In the North Central division the order for the institutions located in that region is *Minnesota, Nebraska, Wisconsin, Illinois, Michigan, Northwestern, Ohio State, Missouri, Indiana, Kansas, Iowa, Purdue, Washington.* All of these of course have a larger patronage in this division than any of the eastern universities, which come in the order *Harvard, Cornell, Yale, Columbia, Pennsylvania, Princeton, Johns Hopkins, Syracuse, Virginia.* Since 1905 *Cornell* and *Yale,* and *Pennsylvania* and *Princeton* have exchanged places. *Columbia's* representation in this group of states has grown from 262 to 514 in six years, *Cornell's* from 381 to 556, *Harvard's* from 526 to 658, *Pennsylvania's* from 139 to 203, *Yale's* from 506 to 523, while *Princeton's* has dropped from 209 to 190. Leaving the state institutions out of consideration in each case, *Wisconsin* is seen to have the largest following in Illinois, being followed by *Michigan, Cornell, Yale, Harvard, Smith. Illinois* leads in Indiana, and is followed in that state by *Northwestern, Michigan, Columbia, Wisconsin, Harvard, Cornell.* In Iowa the order is *Northwestern, Wisconsin, Illinois, Nebraska, Michigan, Harvard;* in Kansas: *Northwestern, Michigan, Illinois, Harvard, Columbia, Yale;* in Michigan: *Northwestern, Wisconsin, Columbia, Illinois, Harvard, Yale;* in Minnesota: *Northwestern,*

1910–1911	California	Columbia	Cornell	Harvard	Illinois	Indiana	Iowa	Kansas	Johns Hopkins	Michigan	Minnesota	Missouri	Nebraska	Northwestern	Pennsylvania	Ohio State	Princeton	Stanford	Syracuse	Texas	Virginia	Washington	Wisconsin	Yale	Amherst	Bowdoin	Dartmouth	Lehigh	Mass. Inst. Tech.	Purdue	Wesleyan	Williams	Bryn Mawr	Mt. Holyoke	Smith	Vassar	Wellesley
North Atlantic Division	*34*	*4679*	*3194*	*5431*	*76*	*8*	*10*	*149*	*1485*	*638*	*9*	*81*	*8*	*6422*	*12778*	*86*	*997*	*49*	*3111*	*4*	*87*	*7*	*96*	*8548*	*404*	*384*	*1037*	*496*	*1118*	*69*	*331*	*433*	*269*	*671*	*1147*	*701*	*1000*
Connecticut		95	67	64				17		15																											
Maine	1	33	12	102				5		8																											
Massachusetts	1	86	102	2354	15		1	13		37	3	2	1	3				1																		
New Hampshire	1	10	11	57	3			3		23																											
New Jersey	3	699	224	69	6			7		3		1																									
New York	10	3676	2421	491	29	2	5	39		21		10																									
Pennsylvania	9	175	339	181	15	2		52		76	3	6	2																							
Rhode Island	1	16	3	76	4			16		3																											
Vermont	1	19	16	27				12		3																											
South Atlantic Division	*8*	*810*	*238*	*147*	*18*	*3*	*30*	*461*	*12*	*72*	*3*	*10*	*3*	*19*	*45*	*19*	*133*	*4*	*1*	*1*	*26*	*2*	*6*	*26*	*97*	*243*	*24*	*12*	*18*	*27*	*13*	*6*	*1*	*27*	*31*	*29*
Delaware		4	11	5						1																											
Dist. of Columbia		14	47	34	3			13		2																											
Florida		7	7	3				3		1																											
Georgia	1	35	11	20	2			23																													
Maryland	2	38	94	29	1			337		1																											
North Carolina		26	18	15	2			18																													
South Carolina		30	9	13	2			7																													
Virginia		46	27	17	3			49																													
West Virginia		10	14	11	3			11																													
South Central Division	*17*	*133*	*91*	*113*	*75*	*30*	*0*	*64*	*88*	*97*	*8*	*89*	*8*	*78*	*25*	*67*	*70*	*13*	*7*	*1908*	*187*	*26*	*45*	*90*	*1*	*8*	*7*	*1*	*1*	*6*	*2*	*28*	*1*	*13*	*7*	*20*	*29*	*36*
Alabama	2	28	10	23	5			9		12		2		3		14	8	1																			
Arkansas		4	8	10	10			2		7				4		12	2	1																			
Kentucky	6	19	13	23	12	22	2	17	1	31		6		9		13	2	2																			
Louisiana		6	7	6			2	7		4		2	1	3		1																					
Mississippi	1	19	5	8	9		2			2		4		2		1																					
Oklahoma	1	7	7	4	11	2	1		34	16		39	2	14		2		1																			
Tennessee		27	19	16	10	3		4		10	1	2	2	11		9	16	2																		
Texas		23	22	23	10	1		11	3	15	1	15	1	11	5	11	13	3	1	1883	26	4	13	23												
North Central Division	*117*	*614*	*666*	*688*	*4188*	*2383*	*2024*	*106*	*2323*	*3699*	*6693*	*2668*	*4648*	*3467*	*26II*	*803*	*190*	*114*	*42*	*19*	*80*	*1028*	*4576*	*623*	*70*	*8*	*136*	*1/0*	*1444*	*13*	*366*	*268*	*246*				
Illinois	23	71	135	117	3333	12	5	19	30	60	1	2361	7	2361	14	51	26	1	5	87	6	19	52	127	23	1	62	33	52	2	30	10	113	65	67	
Indiana	12	63	60	58	182	2343	5	11	1	163	3	17	2	166	18	33	18	11	1	4	62	39	1	39	1	2	1	10	1228	3	4	7	46	20	13		
Iowa	12	41	29	58	104		1903	10	7	60	53	23	75	266	8	21	10	25	1	5	9	133	30		3		13	4	7	2	1	2	11	18		
Kansas	5	30	10	31	37	4	4	2131	4	41	4	9	2	24	8	2	12	3		10	21	25	4	4	12	1	13	9	20	3	3	13	2	7		
Michigan	14	54	35	40	51	2	3	1	1	2541	1	6	2	83	8	9	16	2		2	1	55	39	6	1	3	10	3	9	20	3	7	34	20		
Minnesota	8	49	46	56	75	3	16	13	1	54	1	2430	17	69	3	19	27	8	5	11	907	28	58	4	1	2	13	8	12	1	16	8	23	14	25		
Missouri	11	16	16	24	18	1	10	4	7	34	4	4398	25	1	7	4	1	1				11	3	7		1	3	6	8		1	3	12	8	24		
Nebraska	3	3	2	9	12	1	5	9	69	1	30	1	1	1	2	22	3	1				3					1	2	6							
Ohio	7	107	172	174	44	17	2	17		330	1	12	3	76	2259	52	44	12	8	1	3	40	136	18	1	32	2	33	3	95	3	27	11	14	80	58	52	
South Dakota	2	4	9	14	23		20	4		26	44	16	6	68	2	2	3	1		1	1	47	2		1		4	3	7	3	1	5	2	3			
Wisconsin	4	39	25	35	67	3	14	4		44	71	2	3	175	2	17	3	4	1	4	3514	12	3	3		1	9	3	3		3	5	5	18	28	12	
Western Division	*4077*	*168*	*119*	*186*	*89*	*8*	*22*	*32*	*19*	*229*	*84*	*33*	*49*	*149*	*84*	*71*	*6*	*3*	*1627*	*10*	*6*	*16*	*74*	*130*	*3*	*1*	*63*	*23*	*7*	*11*	*6*	*9*	*48*	*31*	*66*	
Arizona	10	5								6	2	1		6		2	9	1		1		2	13	3												
California	*3867*	55	32	65	12		5	14	3	45	2	2	5	18	3	20	5	1371		1		7	2	40	1	1	21	1	7	1	1	5	1	14	15	
Colorado	17	23	28	32	23		9		9	50	2	6	17	24	2	10	10	20	1	1		1	10	27	4	1	9	2	4	1	3	10	6	15		
Idaho	16	2		4	8		1	1		7		2	2	3		2	2	7				5														
Montana	9	10	5	13	10		1			43	15	6	6	22	2	2		1	4	16		6		1												
Nevada	11	1		3						6				1		1		7				1														
New Mexico	4	2		2	2	1		2		11		8		1		1		4				1														
Oregon	69	14	10	17	3		1	6		21			4	14		6		31	6	1		4		14	7											
Utah	18	12	20	15	5	1		1		9	1	1		33	14	6	1	17	2			3														
Washington	64	26	23	31	21	1	2	7		26	4	1		24		19	6	42	7	1		10		25	2		3		3		6		2	14	3	9
Wyoming	2	2	1	4	6			1		6				3	1	12	4	3	1			1		1												
Insular and Non-contiguous Ter.	*29*	*14*	*48*	*17*	*18*		*2*	*1*		*10*				*6*	*3*	*83*	*16*	*16*			*6*	*11*			*1*	*15*	*1*	*16*	*4*	*1*				*2*	*3*	*4*
Alaska	3	1	1															1																		
Canal Zone				1																															
Hawaiian Islands	19	5	12	9	3							2		1				14				1		6					1							
Philippine Islands	7		22	3	6					4		1		2		1						2		1					4	3				2		3
Porto Rico		8	22	4	3			1		10						2		21				3		2					8	1				1		1
Total	4282	6702	4246	4642	4456	2427	2064	796	2391	4661	5631	2718	4616	3766	2779	4869	1421	1722	3218	1939	722	1067	4620	3193	496	336	1223	618	1404	1600	363	640	407	748	1608	1052	1370

Foreign Countries	California	Columbia	Cornell	Harvard	Illinois	Indiana	Iowa	Johns Hopkins	Kansas	Michigan	Minnesota	Missouri	Nebraska	Northwestern	Ohio State	Pennsylvania	Princeton	Stanford	Syracuse	Texas	Virginia	Washington	Wisconsin	Yale	Amherst	Bowdoin	Dartmouth	Lehigh	Mass. Inst. Tech.	Purdue	Wesleyan	Williams	Bryn Mawr	Mt. Holyoke	Smith	Vassar	Wellesley
North America	*16*	*67*	*49*	*60*	*31*	....	*2*	*11*	*4*	*34*	*3*	*10*	*3*	*41*	*4*	*62*	*8*	*7*	*14*	....	....	*3*	*18*	*31*	....	*1*	....	*13*	*37*	*4*	*1*	*1*	*4*	*2*	....	*3*	*4*
Canada	9	53	16	52	17	....	....	10	2	25	3	3	3	35	2	21	7	4	7	....	....	2	12	30	....	1	....	....	18	....	1	....	4	....	....	3	4
Central America	....	2	7	2	....	....	....	....	....	....	....	....	....	....	....	13	....	....	....	....	....	....	....	....	....	....	....	3	4	....	....	....	....	....	....	....	....
Cuba	....	3	17	2	1	....	1	....	1	1	....	2	....	....	2	10	....	....	7	....	....	....	1	1	....	....	....	6	5	2	....	....	....	....	....	....	....
Mexico	7	8	7	3	13	....	1	1	1	5	....	5	....	4	....	11	....	3	....	....	....	1	5	....	....	....	....	4	9	2	....	1	....	2	....	....	....
Newfoundland	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Indies	....	1	1	1	....	....	....	....	....	3	....	....	....	2	....	7	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....
South America	*4*	*2*	*23*	*4*	*6*	....	....	....	....	*10*	....	*2*	*1*	*4*	*6*	*38*	*1*	*1*	*7*	....	*1*	....	*2*	*1*	....	....	....	*3*	*14*	*2*	....	....	....	....	....	....	....
Argentine Rep	1	....	8	1	2	....	....	....	....	3	....	....	1	3	5		....	....	1	....	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	....	....
Brazil	....	1	2	....	....	....	....	....	....	2	....	....	....	....	....		1	....	3	....	....	....	1	....	....	....	....	2	2	2	....	....	....	....	....	....	....
British Guiana	....	....	....	3	....	....	....	....	....	1	....	....	....	1	....		....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....
Chili	3	1	1	....	....	....	....	....	....	....	....	....	....	....	....		....	1	1	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....
Colombia	....	....	....	1	....	....	....	....	....	2	....	....	....	....	....		....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dutch Guiana	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	38	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ecuador	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....		....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....
Paraguay	....	....	6	....	1	....	....	....	....	....	....	....	....	....	1		....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....
Peru	....	....	2	1	....	....	....	....	....	2	....	2	....	....	....		....	....	2	....	....	....	1	....	....	....	....	....	2	....	....	....	....	....	....	....	....
Uruguay	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....		....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Europe	*18*	*43*	*21*	*43*	*31*	....	*4*	*4*	*2*	*14*	....	*5*	*1*	*25*	*7*	*52*	*3*	*6*	*6*	....	....	*5*	*14*	*14*	*1*	*1*	*1*	....	*11*	*3*	*3*	....	*11*	....	....	*1*	*1*
Austria-Hungary	1	....	....	2	4	....	....	....	....	....	....	....	....	1	1	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Belgium	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bulgaria	....	1	....	2	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Denmark	1	1	1	1	....	....	....	....	....	....	....	1	....	1	....	6	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....
France	1	5	4	5	....	....	....	2	....	....	....	....	....	....	....	9	1	....	....	....	....	....	2	....	1	....	1	....	2	....	....	....	1	....	....	....	....
Germany	3	12	2	8	1	....	1	....	....	3	....	1	....	3	....	8	....	....	1	....	....	....	1	2	....	....	....	....	1	....	....	....	1	....	....	....	....
Great Britain and Ireland	4	9	2	8	9	....	....	....	....	3	....	....	....	4	....	11	2	2	1	....	....	....	....	6	....	....	....	....	1	....	1	....	9	....	....	....	....
Greece	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....
Holland	1	3	....	1	2	....	....	....	1	2	....	....	....	....	....	3	....	2	1	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....
Italy	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	8	....	....	....	....	....	1	....	2	....	....	....	....	1	1	2	....	....	....	1	....	....
Norway	....	....	1	....	1	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	1	1	....	....	....	....	1	....	....	....	....	....	....	....	....
Rumania	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Russia	5	2	3	5	10	....	....	....	1	2	....	2	....	6	3	....	....	....	1	....	....	1	3	....	....	....	....	....	3	....	....	....	....	....	....	....	1
Spain	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Sweden	....	1	1	1	1	....	....	....	....	....	....	....	....	7	....	2	....	....	1	....	....	....	1	1	....	....	....	....	1	1	....	....	....	....	....	....	....
Switzerland	....	1	1	1	....	....	....	....	....	1	....	....	1	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Turkey	1	7	5	5	3	....	3	1	....	3	....	....	....	....	3	1	....	....	1	....	....	1	4	....	....	1	....	....	....	....	....	....	....	....	....	....	....
Asia	*92*	*74*	*58*	*44*	*68*	*4*	*10*	*4*	....	*38*	*3*	*5*	*3*	*26*	*6*	*31*	*6*	*14*	*11*	....	*1*	....	*51*	*43*	*5*	....	*3*	*6*	*34*	*3*	....	*1*	*3*	*4*	....	*6*	*5*
China	24	39	51	24	39	2	1	1	....	26	....	3	....	2	1	20	1	2	4	....	1	....	30	16	1	....	3	6	27	3	....	....	....	....	....	....	3
Corea	....	....	....	....	....	....	....	....	....	....	....	....	1	2	....	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
India	11	6	1	9	6	....	3	....	....	6	....	2	....	8	1	1	1	3	2	....	....	....	4	4	2	....	....	....	....	....	....	....	....	2	....	1	....
Japan	55	27	6	8	17	2	6	2	....	5	3	....	2	8	3	7	2	9	4	....	....	....	16	6	2	....	....	....	4	....	....	....	2	....	....	....	1
Persia	....	1	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	3	1
Siam	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Straits Settlements	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Turkey	2	1	....	2	6	....	....	....	....	1	....	....	....	4	1	2	2	....	....	....	....	....	....	16	....	....	....	....	3	....	....	....	1	2	....	2	....
Africa	*2*	*2*	*7*	*2*	*1*	....	....	....	....	*2*	*1*	....	....	*4*	*1*	*4*	*3*	....	....	....	....	....	*3*	....	....	....	*2*	....	*3*	....	....	....	....	....	....	....	....
Egypt	....	....	1	1	1	....	....	....	....	....	....	....	....	1	....	4	1	....	....	....	....	....	....	....	....	....	2	....	1	....	....	....	....	....	....	....	....
South Africa	2	2	6	1	....	....	....	....	....	2	1	....	....	3	1	....	2	....	....	....	....	....	3	....	....	....	....	....	2	....	....	....	....	....	....	....	....
Australasia	*5*	*3*	*3*	*1*	*1*	....	....	*1*	....	*2*	....	*1*	....	*8*	....	*18*	....	*5*	....	....	....	....	*1*	....	....	....	....	....	*3*	....	....	....	....	....	....	....	....
Australia	3	3	3	....	1	....	....	1	....	1	....	1	....	8	....	18	....	5	....	....	....	....	1	....	....	....	....	....	2	....	....	....	....	....	....	....	....
New Zealand	2	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....
Total (Foreign Countries)	137	191	161	154	138	4	16	20	6	100	7	23	8	108	24	205	21	33	38	0	2	8	89	89	6	2	6	22	102	12	4	2	18	6	0	10	10
Total (United States)	4282	5702	4246	4542	4456	2427	2064	795	2391	4651	5631	2718	4616	3766	2779	4869	1421	1722	3218	1939	722	1067	4620	3193	496	336	1223	618	1404	1600	363	540	407	748	1608	1052	1370
Grand Total	4419	5893	4407	4696	4594	2431	2080	815	2397	4751	5638	2741	4624	3874	2803	5074	1442	1755	3256	1939	724	1075	4709	3282	502	338	1229	640	1506	1612	367	542	425	754	1608	1062	1380

Wisconsin, Harvard, Yale, Illinois, Columbia, Michigan; in Missouri: *Kansas, Illinois, Northwestern, Yale, Harvard, Michigan, Columbia, Cornell;* in Nebraska: *Northwestern, Michigan, Harvard, Illinois, Columbia* and *Cornell;* in North Dakota: *Minnesota, Northwestern, Wisconsin, Illinois, Harvard* and *Michigan;* in Ohio: *Michigan, Harvard, Cornell, Yale, Columbia, Purdue, Smith;* in South Dakota: *Northwestern, Wisconsin, Minnesota, Michigan, Illinois, Iowa;* in Wisconsin: *Northwestern, Minnesota, Illinois, Michigan, Columbia, Harvard, Vassar.* It will thus be seen that *Northwestern* is mentioned as first in no less than seven of the twelve states included in this division. Of the male colleges and technical schools the order is *Purdue, Massachusetts Institute of Technology, Dartmouth, Williams, Amherst;* of the girls' colleges *Smith, Vassar, Wellesley, Bryn Mawr, Mount Holyoke,* the first three mentioned all having a larger representation from this division than either *Pennsylvania* or *Princeton.*

In the Western division (leaving *California* and *Stanford* out of consideration), *Michigan* is still in the lead, with *Harvard, Columbia, Northwestern, Yale* and *Cornell,* each of which attracts over one hundred students from this division, following. *Michigan's* representation has grown from 134 to 229 since 1905; *Harvard's* from 126 to 186; *Columbia's* from 111 to 152; *Yale's* from 78 to 130; *Cornell's* from 76 to 119; *Illinois's* from 41 to 89; *Pennsylvania's* from 22 to 71; while *Princeton's* has dropped from 41 to 31. *Northwestern* leads in Arizona; *Illinois* in Idaho; *Michigan* in Nevada and New Mexico; *Nebraska* in Wyoming. In California the order is *Harvard, Columbia, Michigan, Yale;* in Colorado: *Michigan, Harvard, Cornell, Yale;* in Montana: *Michigan, Wisconsin, Northwestern, Minnesota;* in Oregon: *Michigan, Harvard, Columbia* and *Northwestern* and *Yale;* in Utah: *Northwestern, Cornell, Harvard, Columbia;* in Washington: *Harvard, Columbia* and *Michigan, Yale.*

Taking only the six eastern universities mentioned at the beginning of the article into consideration, and counting ties in fractions, we find that *Harvard* leads in $20\frac{2}{3}$ states of the Union, *Columbia* in $12\frac{5}{6}$, *Cornell* in $6\frac{1}{2}$, *Yale* in $4\frac{2}{3}$, *Pennsylvania* in 4 and *Princeton* in $\frac{1}{3}$.

Cornell maintains its lead in the number of students from insular and non-contiguous territories, being followed by *California* and *Pennsylvania. California* leads in Alaska and the Hawaiian Islands, *Cornell* in the Philippines and Porto Rico and *Northwestern* and *Virginia* in the Canal Zone.

The number of foreign students at American institutions of higher learning continues to show a noteworthy increase. There are enrolled at the group of six eastern universities mentioned at the beginning of the article 821 foreigners, as against 540 in 1905. At the twenty-one universities represented in the tables for 1908–9 and 1910–11 there were in attendance 1,296 foreigners in the former year as against 1,536 in the latter. At the twelve universities represented in the tables for 1906–7 and 1910–11 there were in attendance 898 students from foreign countries in the former year, as against 1,311 in the latter. Adding the foreign clientele of the colleges and technical schools in the table, we find that thirty-seven American institutions attracted no less than 1,782 foreigners during the academic year 1910–11, this figure being, as all the other comparisons have been, exclusive of the summer session attendance. In 1908–9 thirty-four of these institutions attracted 1,467 foreigners, while the same

institutions in 1910–11 had a foreign enrollment of 1,736 students. Taking the representation of foreigners at all of the thirty-seven institutions included in the table, we find that the largest delegations have been sent by the following countries: Canada 344, China 330, Japan 197, Mexico 193, Turkey (in Europe and Asia) 84, India 73, Great Britain and Ireland 72, Cuba 62, Germany 48, Russia 48 and Australia 47. Omitting the foreigners of the three institutions not included in the table for 1908–9 and comparing the foreign enrollment for the year mentioned with that of 1910–11, we secure the following results, the first figure mentioned in each case being that for 1911, the second that for 1909: Canada 335–242, China 326–193, Japan 193–158, Mexico 92–81, Turkey 82–51, India 71–60, Great Britain and Ireland 71–71, Cuba 55–70, Germany 47–56, Russia 46–50 and Australia 47–43. Owing to the fact that *Pennsylvania* did not separate the students from South America into the individual countries from which they hailed, it is impossible to determine whether the Argentine Republic should be included in the above list of countries with a representation of 46 or over. 548 of the 1,782 foreigners at the thirty-seven institutions in the present table hailed from North America, 132 from South America, 351 from Europe, 662 from Asia, 37 from Africa and 52 from Australasia. Omitting the three institutions (*Syracuse, Texas* and *Washington*) not included in the table for 1909 and comparing the figures for the two years in question, we find that between 1909 and 1911 the representation from North America increased from 460 to 531, that from Europe from 313 to 340, that from Asia from 458 to 651, that from Africa from 18 to 37, while that from South America decreased from 154 to 125, and that from Australasia from 64 to 52, the largest increase thus having taken place in Asia.

If we compare the foreign clientele of twenty-one of the leading American universities,[1] with that of the twenty-one German universities, we find that America is still far behind Germany in the matter of attracting foreign students to its higher institutions of learning. During the winter semester of 1910–11, the twenty-one German universities attracted altogether no less than 4,672 students from foreign countries, as against 1,576 foreigners at the American universities mentioned. The latter figure would no doubt be slightly increased in case the University of *Chicago,* for which geographical distribution figures are unfortunately not available, were substituted for one of the smaller middle western universities. The German universities draw 4,046 students from other European countries, 398 from North and South America, 203 from Asia, 20 from Africa and 5 from Australasia, while the American universities attract 478 students from North American countries outside of the United States, 112 from South America, 318 from Europe, 587 from Asia, 32 from Africa and 49 from Australasia, in other words, the American universities lead in every continent with the exception of Europe. Almost half of the European foreigners at German universities hail from Russia, namely, 1,998 out of 4,046, this country being followed by Austria-Hungary with 760, Switzerland with 353, Bulgaria with 159, Great Britain and Ireland with 142, Rumania with 137, Greece with 83, Servia with 78, Luxemburg with 61 and Turkey with 57, the remaining countries

[1] California, Columbia, Cornell, Harvard, Illinois, Iowa, Johns Hopkins, Kansas, Michigan, Minnesota, Missouri, Nebraska, Northwestern, Ohio State, Pennsylvania, Princeton, Stanford, Syracuse, Washington, Wisconsin, Yale.

sending less than fifty students each. Among European countries the twenty-one universities of the United States lead only in Denmark (12 *vs.* 11), the American figures in European countries mentioned above being in every case far below the German figures, namely Russia 44, Austria-Hungary 11, Switzerland 7, Bulgaria 5, Great Britain and Ireland 61, Rumania 2, Greece 4, Servia and Luxemburg 0 and Turkey 38. Almost a third of the foreign students in attendance on German universities are at the University of *Berlin*, namely, 1,492 out of 4,672. *Berlin* is followed by the following universities in the order given: *Munich* 845, *Leipzig* 634, *Halle* 285, *Heidelberg* 186, *Königsberg* 185 (of whom 179 hail from Russia), *Göttingen* 141, *Freiburg* 127, *Jena* 119, *Bonn* 117, *Breslau* 107, *Strassburg* 105, the remaining institutions all attracting less than one hundred foreigners each. Figured on a percentage basis we find that 8.5 per cent. of Germany's 54,823 university students are foreigners, whereas only 2.1 per cent. of 74,325 students attending the twenty-one American universities mentioned hail from foreign countries. It should be borne in mind that the American institutions in every instance include an undergraduate academic department and in most instances a technical school, which is not the case for the German universities, but the comparison here outlined undoubtedly conveys a fairly accurate idea of the situation.

Of the three middle western universities that were included in the table for 1904–5, *Illinois* shows a gain in students from foreign countries during the six years of 120, *Michigan* of 62 and *Indiana* a loss of 3, while the total increase in foreign students during the same period at the nine universities included in the above table amounts to 460.

Examining the foreign delegations of the different American institutions by continents, we observe that the order in North America is *Columbia, Pennsylvania, Harvard, Cornell;* in South America: *Pennsylvania, Cornell, Massachusetts Institute of Technology, Michigan;* in Europe: *Pennsylvania, Columbia* and *Harvard, Illinois;* in Asia: *California, Columbia, Illinois, Cornell;* in Africa: *Cornell, Northwestern* and *Pennsylvania;* and in Australasia: *Pennsylvania, Northwestern.* In the countries that send at least ten students to any one institution, the order is as follows: Canada: *Columbia, Harvard, Northwestern;* Central America: *Pennsylvania, Cornell, Massachusetts Institute of Technology;* Cuba: *Cornell, Pennsylvania, Syracuse;* Mexico: *Illinois, Pennsylvania, Massachusetts Institute of Technology;* Germany: *Columbia, Harvard* and *Pennsylvania;* Great Britain and Ireland: *Pennsylvania, Columbia* and *Illinois* and *Bryn Mawr;* Russia: *Illinois, Northwestern, California* and *Harvard;* China: *Cornell, Columbia* and *Illinois, Wisconsin;* India: *California, Harvard, Northwestern;* Japan: *California, Columbia, Illinois;* Turkey: *Yale, Illinois, Columbia;* and Australia: *Pennsylvania, Northwestern.*

Rudolf Tombo, Jr.
Columbia University

THE SMITHSONIAN EXPEDITION TO STUDY THE HEAT OF THE SUN

Director Abbot, of the Smithsonian Astrophysical Observatory, has just returned from a five months' astronomical expedition to Bassour, Algeria. The object of the expedition was to confirm or disprove the supposed variability of the sun. The Astrophysical Observatory has been for seven years making observations on Mt. Wilson, in California, on the daily quantity of heat received from the sun. The observations are arranged in such a manner as to indicate not only the quantity

of solar heat reaching the earth, but also the quantity of heat which would reach a body like the moon, which has no atmosphere.

The observations have indicated that the sun is probably a variable star having a range of variation amounting to from five to ten per cent. within an irregular interval of from five to ten days. Last year Mr. Abbot observed in Algeria, while his colleague, Mr. Aldrich, observed on Mt. Wilson, in California. The object of thus duplicating the measurements was to avoid being misled by any local atmospheric conditions which might have affected Mt. Wilson observations. As nearly one third of the circumference of the earth lies between Mt. Wilson and Algeria, it could not be expected that a similar local disturbance could affect both stations at the same day in the same manner. The observations of 1911 strongly supported the belief that the sun is variable, but owing to cloudiness their number was not sufficient to fully establish this point. Hence, it was thought best to return to Algeria this year.

Mr. Abbot was assisted in Algeria by Mr. Anders Knutson Angström, of Upsala, Sweden. Mr. Angström comes from a distinguished family of scientists. His grandfather, Anders Angström, is the one of whom Kayser says in his great work on spectroscopy, "Now arose a man so great that his name will be forever associated with the history of spectroscopy." Mr. Angström's father, Knut Angström, was scarcely less distinguished than the grandfather, and invented many valuable instruments for measuring the radiation of the sun and earth. The present Mr. Angström is much interested in the same problems that occupied his father, and is now pursuing advanced work at Cornell University.

The observations made by the Smithsonian party in Algeria this year were apparently very satisfactory. They occupied sixty-four days, and on more than fifty of these days Mr. Fowle made similar observations on Mt. Wilson, in California. It can hardly be doubted that the results of the work of 1911 and 1912 will thoroughly establish the supposed variability of the sun, or will show conclusively that this hypothesis can no longer be held.

PROFESSOR MORRIS LOEB

AT a special meeting of the board of trustees of the Chemists' Club of New York City, held October 8, the following resolutions offered by committee consisting of Mr. Ellwood Hendrick, Mr. Clifford Richardson and Mr. Walter E. Rowley, were adopted:

WHEREAS Morris Loeb, the president of the club, has been taken from us by death, and

WHEREAS he was the leading spirit in bringing to fulfillment ambitions and plans that had long been ours, and

WHEREAS he was always ready to shoulder burdens and to give help, and

WHEREAS he was a man of order, and of integrity in mind and in heart, sincere in scholarship, living without malice or scorn, speaking no evil, and generous in judgment, and

WHEREAS we were drawn to him by ties of deep and abiding affection, now, therefore, be it

Resolved, that we make this minute of our poignant grief at his passing, and that we cherish his memory as another of his great gifts to science and to humanity.

SCIENTIFIC NOTES AND NEWS

THE autumn meeting of the National Academy of Sciences will be held in New Haven, beginning Tuesday, November 12, 1912, at 10 A.M. By invitation the sessions will be held in Sloane Physics Laboratory of Yale University.

SIR WILLIAM RAMSAY lectured at the Johns Hopkins University on October 18, when the degree of doctor of laws was conferred on him.

Nature states that Sir George Darwin, Plumian professor of astronomy at Cambridge University, has undergone a severe operation after which he is making good progress toward recovery.

THE Fritz Schaudinn medal for work in microbiology has been awarded by the international committee to Dr. Carlos Chagas, of the Institute Oswaldo Cruz Manguinhos, Rio de Janeiro.

Dr. Carl Runge, professor of mathematics at Göttingen, recently Kaiser-Wilhelm professor at Columbia University, has been appointed "Geheimsregierungsrat."

Dr. Benjamin Boss, son of the late Dr. Lewis Boss, has been appointed acting director of the Dudley Observatory, Albany.

Colonel Martin V. Calvin, for the past six years director of the Georgia Agricultural Experiment Station, has announced his retirement from the station.

Mr. E. Grant Hooper, superintending chemist of the government laboratory, London, has been appointed deputy-government chemist, in succession to Mr. H. W. Davis, who has retired.

Dr. F. Bidling Meyer has been appointed director of the Observatory for Terrestrial Magnetism at the University of Munich.

Dr. A. B. Hamilton, who is now abroad, has been appointed a delegate from the University of Minnesota to the first International Congress of Comparative Pathology, which meets in Paris, October 17–23.

Professor Josiah Royce, of Harvard University, will give a course of eight Lowell lectures on Monday and Thursday afternoons beginning November 18, on "The Problem of Christianity."

A course of lectures at Union College on the Ichabod Spencer Foundation will be delivered by Dr. Rudolf Eucken, professor of philosophy at the University of Jena and visiting professor at Harvard University. The subjects of his lectures will be, "Goethe as a Philosopher," "Idealism and Realism in the Nineteenth Century," "Defence of Morality," and "Philosophy and Religion."

The sixth of the Weir Mitchell lectures of the College of Physicians was given on October 21 in Mitchell Hall by Dr. G. H. F. Nuttall, of Cambridge, England, on "Some Recent Advances in Our Knowledge of the Mode of the Spread of Protozoan Diseases."

Professor Borel, the French mathematician, is the guest of the University of Illinois this week. Professor Borel comes directly from Houston, Texas, where he has been attending the Rice Institute's inaugural exercises.

Among the recent lectures delivered by Dean Eugene Davenport, of the College of Agriculture, was one on "The Church and Country Life" delivered at Rantoul on October 11 and another on "Agriculture as a Career for Boys," delivered October 8 at the Illinois State Fair at Springfield. Some twenty men from the faculty of the College of Agriculture gave lectures and instruction at the State Fair Boys School of Agriculture.

At McGill University the annual university lecture for the current year was given on October 8 by Professor Francis E. Lloyd. He took for his subject "The Artificial Ripening of Bitter Fruits."

The first meeting of the Royal Geographical Society, London, will be held in the evening of November 4, when Miss Ellen Churchill Semple, of the University of Chicago, will give an amply illustrated lecture on "The Geography of Japan and its Economic Development."

Professor W. M. Flinders Petrie, F.R.S., will deliver the address on the occasion of the opening of the extension to the Manchester Museum on the afternoon of October 30.

The Henry Sidgwick memorial lecture at Newnham College will be given by Professor James Ward in the College Hall on November 9. The subject will be "Heredity and Memory."

Dr. William Willard Daniells, emeritus professor of chemistry of the University of Wisconsin, has died at the age of seventy-two years.

Dr. Frank S. Billings, formerly director of the Nebraska State Veterinary Hospital and a leading authority on veterinary surgery, has died at the age of sixty-seven years.

Professor Herm. F. Wiebe, a member of the Physical Reichsanstalt, has died at the age of sixty years.

The U. S. Civil Service Commission announces an open competitive examination for

men only, for a specialist in agronomy in the Office of Experiment Stations, Department of Agriculture, at a salary of $1,800 per annum, and for associate physicist in the Bureau of Standards, Washington, D. C., at a salary ranging from $1,800 to $2,000.

MEMBERS of the American Association for the Advancement of Science expecting to contribute to the program of Section D are requested to so inform G. W. Bissell, secretary, East Lansing, Mich., as soon as possible. This section receives no support from affiliated societies, but the programs in the past few years have been good and the sessions well attended. The Cleveland meeting should be no exception.

THE geographers who took part in the transcontinental excursion returned to New York last week and held scientific sessions in the hall of the American Geographical Society. On Friday evening there was a banquet at the Waldorf-Astoria. Most of the foreign geographers sailed for their homes on the nineteenth instant.

THE 220 German physicians who have been visiting places of scientific interest in this country after the International Congress on Hygiene and Demography sailed on the morning of October 9 on the liner *Victoria Louise*.

THE next International Physiological Congress will be held at Groningen from September 2 to 6, 1913.

A SECOND exposition of inventions will be held at the coliseum, St. Louis, from November 11 to 17.

MRS. RUSSELL SAGE has bought Marsh Island, Louisiana, at a cost of $150,000, for a bird refuge. The island is on the gulf coast, southwest of New Orleans, and is about eighteen miles long and nine miles wide, and contains about 75,000 acres. It has long been a famous winter feeding ground for ducks and geese and various other migratory birds, and has been for many years one of the most popular resorts in the south for market hunters. Mrs. Sage will place control of the island in whatever hands will best accomplish her purpose, either the federal government, the state of Louisiana or some association organized for bird protection. The matter was brought to Mrs. Sage's attention by Edward A. McIlhenny, of Avery Island, La., who, in conjunction with Charles Willis Ward, of Michigan, recently gave a 13,000-acre bird refuge on Vermilion Bay to the state of Louisiana.

THE Somerset County Council has set aside Brean Down, a little promontory stretching into the British Channel as a sanctuary for birds, and the Society for the Protection of Wild Birds has provided a guardian.

A CABLE message has been received at the Harvard College Observatory from Professor Perrine, director of the Cordoba Observatory, from Christiana, Minas Geraes. Brazil, "Rain." This appears to indicate that observations of the eclipse of the sun on October 9–10 were prevented by bad weather.

THE return of marriages, births and deaths registered in England and Wales, states that the number of persons married during the first quarter of the present year corresponds to an annual rate of 9.8 per 1,000 of the population; this is 1.5 per 1,000 below the mean marriage rate in the ten preceding first quarters and is the lowest marriage-rate recorded in any quarter since the establishment of civil registration. The births in the second quarter of the present year correspond to a rate of 23.9 annually per 1,000 of the population; this is 3.7 per 1,000 below the mean birth-rate in the ten preceding second quarters, and is the lowest birth-rate recorded in any second quarter since the establishment of civil registration. The deaths last quarter correspond to an annual rate of 12.7 per 1,000 persons living; this rate is 1.7 per 1,000 below the mean rate in the ten preceding second quarters, and is the lowest death-rate recorded in any second quarter since the establishment of civil registration.

ON August 30 last, the Philosophical Institute of Canterbury, New Zealand, celebrated its jubilee by holding a conversazione in Christchurch, the capital of the province. There was a large gathering, local bodies,

educational institutions and the parliament of New Zealand being represented. Among the guests were the Mayor of Christchurch and also Mr. G. M. Thomson, M.P., who has done much scientific work in the dominion. The president of the institute, Dr. L. Cockayne, F.R.S., presided. He delivered an interesting address, in which he showed what science has done for civilization, and what it is doing in New Zealand and in other parts of the world. He also briefly sketched the history of the institute, and referred to the work done in the past by Sir Julius von Haast (the first president), Captain F. W. Hutton and other members. He pointed out that in recent years the institute has taken important enterprises in hand, notably the publication of the "Index Faunæ Novæ Zealandiæ" and "The Subantarctic Islands of New Zealand," the latter a large two-volume publication, the result of a scientific expedition the institute was the means of sending to the Auckland and Campbell Islands, south of New Zealand, in 1907. During the evening, Mr. Thomson, on behalf of the board of governors of the New Zealand Institute, presented to Dr. Cockayne a sum of money, which accompanies the Hector medal, awarded for the first time some months ago. The medal was struck by the New Zealand Institute in memory of the late Sir James Hector, and has been awarded to Dr. Cockayne for his researches in ecological botany. At the gathering, a large number of messages were received congratulating the Canterbury Institute on attaining its jubilee, and Dr. Cockayne on having been elected a Fellow of the Royal Society. Amongst those who sent congratulatory messages were the Prime Minister of the Dominion (the Hon. W. F. Massey) and other members of the government. In a speech, Mr. Thomson announced that the government intended to help the scientific workers of the dominion, especially by offering them facilities in regard to the publication of scientific papers and reports.

The annual meeting of the Swedish Museums Association was held in Wisby, in conjunction with that of the Swedish Archeologists, on August 9–12, under the presidency of State Antiquary Dr. Oscar Montelius, who was reelected to the same office for the ensuing year, together with the secretary, Dr. R. Uppmark, and the treasurer, Dr. Otto Janse. The question of state contribution to provincial museums, which was discussed at last year's meeting and has since then been under the consideration of the Academy of Antiquities, was again discussed, and it was decided to approach the government with a request for the sum of, at most, 30,000 kronor ($7,700), to be distributed among provincial museums according to their respective means. The question of payment for treasure trove has also been under the consideration of the Academy of Antiquities. It was proposed that the term should include all objects of metal, both bronze and copper, as well as those silver; but it was decided that the final proposals of the Academy should be referred to all the provincial museums for their opinion, which should then be acted upon by the Museums Association. Among the papers read at the meeting were the following: "Sarcophagi and Reliquaries," and "Relics of Heathen Times in Gotland," both by Professor Montelius; "An Ancient Shrove-tide Custom," by Miss Louise Hagberg; "The So-called Battle Graves of Gotland," by Mr. Hans Hansson, in whose opinion these remains are not graves but ancient foundations; "The Country Churches of Gotland," by Dr. Sune Ambrosiani; "The Dwelling-houses of Gotland," by Lektor Karl A. Berlin; "The City Walls of Wisby," by Dr. Emil Ekhoff; "The Church Organs of Gotland," by Mr. C. F. Hennerberg; "The Church Furniture of Gotland," by Dr. Otto Janse; "Museum Technique," by Dr. Bernard Salin, director of Nordiska Museet, who dealt chiefly with registration and cataloguing. The concluding lecture by Lektor N. Klintberg, entitled "Sketches from the Peasant Life of Gotland" showed a selection from the large series of photographs which Dr. Klintberg has been taking for so many years in order to preserve for future generations a complete representation of every operation in

the life of his fellow-countrymen—a life that retains so many characteristics of the middle ages but is now rapidly passing away. Excursions were made to the numerous ruins of Wisby, and to several of the churches and archeological remains on the island.

IT is stated in *Nature* that the geological department of the British Museum (Natural History) has recently received a valuable gift of Wealden fossils from the Reverends P. Teilhard and F. Pelletier, S.J., who made the collection during a four years' residence near Hastings. A large proportion of the specimens are small teeth from bone-beds which had previously been very little examined, and among them is the unique mammalian tooth described under the name of *Dipriodon valdensis* by Dr. Smith Woodward in 1911. There are numerous teeth of the dwarf crocodile *Theriosuchus,* which has hitherto been known only from the Purbeck Beds. The series of plant-remains is also important and will shortly be described by Professor A. C. Seward in a communication to the Geological Society.

THE experiments on orchard fertilization and cultural methods, started six years ago by Dr. J. P. Stewart, experimental pomologist of the Pennsylvania State College, are attracting attention from both official and practising horticulturists. Parties from foreign countries as well as from our own and neighboring states have recently visited a number of these experiments in company with Dr. Stewart. These parties have included Dr. Girolamo Molon, the leading horticulturist of Italy; Professor Niels Esbjerg, director of the Pomological Experiment Station at Esbjerg, Denmark; Professor J. W. Crow, head of the department of pomology at the Ontario Agricultural College at Guelph, Canada; Professors Price and Drinkard from the Virginia Experiment Station; and Mr. W. T. Creasy, president of the State Horticultural Association of Pennsylvania. This association held its summer meeting in one of the experimental orchards at which Mr. H. W. Collingwood, editor of *The Rural New-Yorker,* was present, besides representatives of other agricultural journals and several hundred practical fruit-growers and farmers.

UNIVERSITY AND EDUCATIONAL NEWS

MR. GEORGE R. AGASSIZ has given Harvard University $25,000 for the general use of the Museum of Comparative Zoology; it is not to be used for anything connected with undergraduate instruction. An anonymous friend has given $10,000 to be used to rebuild the front portion of the central section of the Gray herbarium.

ON October 6, Augustana College and the theological seminary, Rock Island, Ill., came into the possession of endowment funds amounting to $117,000. Of this amount $46,000 was given by the will of the late Senator C. J. A. Ericson, of Boone, Iowa, on condition that an equal sum in cash be raised. Mr. C. A. Smith, of Minneapolis, Minn., gave $25,000 to be used as a fund for purchasing books for the Senkman Memorial Library.

THE arrangements for the administration of the Graham Bequest have been completed by the University of London. Dr. Charles Bolton has been elected director of research and Mr. H. G. Butterfield, Graham scholar. By means of the bequest 15 workers in the research laboratories of the school are in receipt of grants; a quantity of valuable apparatus has also been purchased and a special library furnished for the use of research workers.

AT the last meeting of the board of trustees of the University of Illinois it was definitely decided that the College of Literature and Arts, and the College of Science should be consolidated into one college to be known as the College of Arts and Sciences. Although the board of trustees acted favorably upon the question nothing definite in regard to the details of the consolidation has been done.

MRS. HUNTINGTON WILSON, of Washington, D. C., has established a lectureship on eugenics at the University of Virginia. Professor H. E. Jordan, of the university, has been selected as the lecturer.

Professor John M. Coulter, of the University of Chicago, gave the students of the Western College and their guests an address at the annual College Day festivities. Professor Coulter told of the power of social service in the individual life and how the individual ideal was changing, including in its conception the welfare of others in ways little known a decade ago. The laying of the corner stone of the new gymnasium was part of the ceremonies. Honorable Robert S. Fulton, of Cincinnati, made the principal address. He was followed by members of the alumnæ, by Honorable J. S. Crowell, president of the board of trustees, and by Mary A. Sawyer, acting president of the college.

The seventy-fifth anniversary of the founding of Mount Holyoke College was celebrated on October 8 and 9. The program on Tuesday consisted of alumnæ commemoration exercises in Mary Lyon chapel, with a pageant on the green in the afternoon. On Wednesday occurred the intercollegiate exercises in the outdoor auditorium including the dedication of the new memorial gateway. Of the fourteen honorary degrees conferred on this occasion the following names are noted. Dr. Mary Almira Smith, of Boston, D.Sc. The degree of LL.D. was conferred on President Alexander Meiklejohn, of Amherst College, Katharine Bement Davis, superintendent of Bedford Reformatory, Bedford, N. Y., Julia Clifford Lathrop, head of the Children's Bureau, Washington, D. C., and Lillian N. Wald, head of the Henry-Street Settlement in New York.

The following new buildings have just been occupied or are in course of construction at the University of Minnesota: the Institute of Anatomy, housing the departments of comparative anatomy and human anatomy; the new Millard Hall, providing quarters for the department of physiology and the department of medicine; the Main Engineering Building for mechanical and civil engineering, a mechanical laboratory for the same departments; a new laboratory for the school of chemistry; a Mechanic Arts Building with shops for the department of architecture; a new dairy barn for the division of animal husbandry.

Cornell University Medical College opened on Wednesday, October 2, 1912, with an enrollment as follows: for the degree of M.D., first year, 39; second year, 24; third year, 20; fourth year, 19; special students (work not leading to the degree of M.D.), 5; doctors in medicine engaged in research, 7; for the degree of Ph.D., 2; making a total of 116 students. There is an increase over last year of 15 students in the enrollment for the course leading to the degree of M.D. All students now registered, with the exception of those who are pursuing the combined seven-year courses leading to the degrees of A.B. and M.D. are graduates in arts or sciences, or doctors of medicine doing advanced work.

Dr. Edward Bradford Titchener, who has been Sage professor of psychology in the graduate school of Cornell University, has now been appointed head of the department of psychology and lecturer in the College of Arts and Sciences. He will give this year a course of lectures in elementary psychology.

Samuel Weiller Fernberger, Ph.D., instructor in psychology in the University of Pennsylvania, has accepted a similar position at Clark University.

Mr. F. C. Ayers, a graduate fellow last year of the University of Chicago, has gone to the University of Oregon as the head of the department of education.

Dr. L. R. Littleton, A.B. (Southern University, '07), M.A. (Tulane, '10), Ph.D. (Illinois, '12), has been appointed instructor in chemistry at Grinnell College to succeed Leonard M. Liddle, Ph.D. (Yale, '09), who has accepted a fellowship in industrial chemistry at the University of Pittsburgh. Mr. J. F. Mangold, B.S. (Cornell College, '07, CE., '10), has resigned the position of instructor in mechanical engineering at the Mississippi Agricultural and Mechanical College, to accept an assistant professorship in engineering at Grinnell College. He succeeds Mr. L. D. Norsworthy, who has been elected to an instructorship at Columbia University.

DR. F. R. MILLER has been appointed lecturer in physiology in McGill University.

MR. R. E. STONE has been appointed lecturer in the botanical department of the Ontario Agricultural College.

MR. W. H. MILLS, M.A., of Jesus College, has been appointed demonstrator to the Jacksonian professor of natural experimental philosophy at Cambridge University in place of the late Mr. H. O. Jones.

DISCUSSION AND CORRESPONDENCE

"THEORETICAL ASTRONOMY"

TO THE EDITOR OF SCIENCE: Referring to Professor MacMillan's review of Buchholz's Klinkerfues's "Theoretische Astronomie," in SCIENCE for September 6:

Professor MacMillan objects to Klinkerfues's limitation of the title "Theoretical Astronomy" to the theory and practise of orbit determinations, and the great majority of astronomers will certainly agree that this is illogical and unfortunate; but is not Professor MacMillan's application of the term "Computational Astronomy" to the same field even more illogical and unfortunate? The computational side in many other branches of astronomical endeavor is as extensive, both relatively and absolutely, as in that of orbit determinations. To illustrate: Studies of the solar corona, of atmospheric refraction, of the motion of the solar system, of Algol variable stars, of the evolution of double stars, of cosmogony in general, and so on almost indefinitely, have both theoretical and computational sides; and who is wise enough to say which side in any of the subjects mentioned will be the predominant one in the future?

Can we do better at present than to continue the already extensive use of Gauss's title, "Theorie der Bewegung der Himmelskörper," and of Oppolzer's title, "Lehrbuch zur Bahnbestimmung"?

Again, does not Professor MacMillan's characterization of this subject as the "bookkeeping" of astronomical science convey an unfortunate impression? The subject received the best efforts of Kepler, Gauss, Olbers, Oppolzer, and many others; and advances made during the present generation give promise that this field is worthy of the highest abilities of astronomers to come. Could we not, with equal justification, include in the "bookkeeping" of astronomy essentially all studies of double stars, of variable stars, of spectroscopic binary stars, of stellar positions and proper motions, of stellar radial velocities, of sunspot spectra, and so on through a long list?

W. W. CAMPBELL

MT. HAMILTON,
September 18, 1912

THE UNANIMOUS VOTE RULE IN THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

THE central branch of the American Society of Zoologists unanimously adopted the report of its committee on nomenclature[1] containing the following:

> All propositions for amendments to rules on nomenclature which are approved by a majority of the International Commission on Nomenclature shall be submitted to the International Congress for decision by vote in open meeting.

It is not the purpose of the present communication to influence any person's mind for or against the foregoing resolution, which is practically identical with a proposition that has recently arisen in Austria. A brief statement of the origin of the present method of procedure may, however, be interesting to some zoologists who desire a change in the methods.

The International Commission on Zoological Nomenclature was appointed in 1895. For three years it studied the subjects submitted to it, its members coming together at their own expense from five different countries in a meeting of nearly a week's duration some months prior to the meeting of the Congress. The Commission was unanimous upon a number of propositions, but was divided upon several others. Upon the latter propositions majority and minority reports were submitted.

At the next meeting of the Zoological Congress the Commission was prepared to submit its formal report, but learned that no place on

[1] See SCIENCE, 1912, June 14, pp. 933–934.

the program had been reserved for this purpose. As secretary of the commission I inquired into the reason, and was informed that the committee of the congress had decided that unless the report of the commission were unanimous, its submission to the general meeting would jeopardize the success of the congress, and would turn the general meeting into long-drawn-out discussions on very dry and technical points in nomenclature upon which very few of the members were well informed.

Accordingly, the first three years' work of the commission was not acted upon.

The commission was, however, granted a few minutes at one of the meetings to make a general report of progress and to request that the size of the commission be increased.

Three years later the commission had by mutual concessions obtained unanimous vote on most of its propositions, but there still remained several with divided vote. Repeated conferences were held with many different prominent zoologists, and the consensus of opinion was that the congress would not listen to any report that was not unanimous.

In order not to take up the time of the general meeting with technical discussions on nomenclature, the plan was instituted of having an open session when any person interested in nomenclature could present any point to the commission, and could discuss the commission's report. This open meeting is held prior to the date when the commission reads its report to the congress. The report is read, however, at this open meeting, and if any one present objects to any portion of it, he has to convince only one member of the commission that the portion in question should be stricken out. That one commissioner has the power to prevent the portion in question from going before the congress.

By this method of procedure the general meetings are safeguarded from being turned into discussions on nomenclature. Further, sudden and unwise changes in the rules are avoided. The theory is that if fifteen specialists on nomenclature can agree upon any one point, the mathematical probabilities are that that point is correct. Obtaining a unanimous vote thus assures the presentation of an amendment to the congress, and a failure to obtain a unanimous vote protects the rules from any sudden innovation and from vacillating changes that might be carried through with a vote of eight to seven, this vote changing from one side to another in successive congresses. At the Berlin Congress the motion was carried that the congress adopt and approve all of the propositions in the report that had been accepted unanimously by the commission, and that all propositions upon which there was a divided vote be referred back to the commission. The commission was also given thoroughly to understand that the congress did not care for any but unanimous reports in the future.

From the foregoing it will be seen that the present mode of procedure developed not upon the initiative of the commission, but of the congress itself, and in view of the experience the commission has had before two congresses, it seems that the commission can not be expected to report divided votes unless specifically instructed to do so by the congress.

An interesting point arises. A great many questions in nomenclature have been settled, and in not a few instances reports have been obtained only by mutual concessions after long conferences. When a commissioner has been outvoted in any given proposition, namely, when he has failed to obtain a unanimous vote for his proposition, it has been customary for him not to bring the matter forward a second time.

Assuming now that the recommendation of the central branch of the American Society of Zoologists is adopted by the congress, and that the commission is instructed to report divided votes in the future, the interesting point arises as to whether the large number of questions that have been definitely disposed of since 1896 under the present method of procedure will be reopened, and will be allowed before the general session of the congress.

C. W. Stiles,
Secretary, International Commission on Zoological Nomenclature

THE SYMBOLIC STATEMENT OF RELATIONSHIPS

THE simplest way in which to state the relationship of two persons symbolically is to denote each by a number indicating the number of generations since the nearest common ancestor (counting that ancestor as one) and to write the numbers with a sign of relationship between them, that one being placed first whose relationship is to be expressed. A convenient and appropriate symbol of relationship is the ratio sign [:]. Thus the relationship of parent would be 1:2, of child 2:1. Here and elsewhere in this paper a person is regarded as his own ancestor, bearing to himself a relationship of identity [1:1]. The relationship of grandparent would be 1:3, of grandchild, 3:1, of great-grandparent, 1:4, and so on. That of brother or sister would be 2:2, of own-cousin 3:3, of second cousin 4:4, etc., the degree of cousinship being found by subtracting two from the symbol. The relationship of uncle or aunt would be 2:3, of niece or nephew 3:2, of great-uncle or aunt 2:4, and so on. This method also discriminates between relationships for which we have no separate names; thus we speak of a "first cousin once removed," whether we mean the older or younger of the two. The former would be symbolically, 3:4 and the latter 4:3. Likewise a third cousin four times removed would be 5:9 or 9:5. These are evidently as different relationships as parent and child or uncle and niece.

Suppose now we desire to take sex into account, as we do in our names when we distinguish between sister and brother or uncle and aunt. When we do thus distinguish we take account only of the sex of the person whose relationship is being stated. A male person is a brother alike to a male or female child of the same parents. A man is an uncle and a woman an aunt, no matter whether nephews or nieces are in question. In cousinships we do not consider sex at all in naming the relationships. We can do as much as this by attaching a sex initial (M for male and F for female) to the first number in the symbol, thus: 2(M):3 (uncle); 2(F):3 (aunt); 3(M):2 (nephew); 3(F):2 (niece).

But we may go further than our ordinary nomenclature and say 2(M):3(M) (the relation of uncle to nephew), 1(M):3(F) (relation of grandfather to granddaughter), etc.

Furthermore, we may, if desired, substitute for each number a series of sex-initials giving the line of descent in each case, and thus expressing facts that would require many sentences if we were to attempt to put them into words. Thus the following all express the relation of an elder to a younger second cousin once removed, the lines of descent by sex being different in the various cases

MMMM	: MMMMM
MFMF	: MMFFF
FFFM	: FMMMF
etc.	etc.

The first letters, since they denote the common ancestor, will in all cases be the same.

Hitherto no distinction has been made between relationship of the whole or of the half blood. Thus, in the first formula just above the common ancestor is a man, and there is no effort to tell whether or not the descent is through the same or different mothers. If it is desired to emphasize the fact that the relationship is of the whole blood the two letters (MF) may be used together when necessary. Thus, (MF)M:(MF)F is the relationship of own brother and sister, while FM:FF would be that of half brother and sister on the mother's side. Generally it will be necessary to make this distinction only in the case of the common ancestor. Intermarriages in the line, causing double relationships, introduce complexity. The only way to denote these is to make a symbol for each relationship separately and join them by a plus sign. In very complicated cases the symbol ceases to be an abbreviation and the diagram is clearer.

Suppose that a brother and sister marry a brother and sister, so that their children are double cousins. The relationship, if those children are boys, is:

[(MF)MM:(MF)FM] + [(MF)FM:(MF)MM].

Even here, the symbol becomes rather cumbersome, and this is the simplest case of a double relationship.

Arthur E. Bostwick

SCIENTIFIC BOOKS

Magnetism and Electricity. By Brooks and Poyser. Longmans, Green and Co. Pp. vii + 633; 413 illustrations.

This volume is intended by the authors to replace Poyser's "Advanced Magnetism and Electricity" as the latter book had become out of date owing to the enormous progress made in electrical theory during the last twenty years. The subject-matter is presented in experimental form; practically every point treated theoretically is illustrated by one or more experiments. The method is admirable, especially for a text in physics; as the authors state in the preface, it is important that a beginner should learn to recognize that all theory is based upon a groundwork of experimental fact. The book treats all of the subjects usually found in a text on electricity and magnetism and the treatment is very well done in most cases. The authors' emphasis upon the student's comprehension of the significance of the lines of force of the electric and magnetic field we think well worth while; the more the student is made to understand Faraday's ideas in regard to the electric and magnetic fields the better prepared he will be to understand the operation of instruments and machines.

The modern conception of the electric current as the flow of electrons is used in the book and its use is undoubtedly justified at this time, by the results obtained from the experiments of various researchers along this line. A chapter is devoted to the discharge of electricity through gases; in the discussion use is made of the latest theories in regard to this phenomenon. The chapters on Dynamos and Motors and on Alternating Currents are entirely inadequate to be of much service to the student. We think they should have either been omitted altogether or else treated more comprehensively. Any adequate treatment of dynamos and motors requires a deal of space and should not be attempted in such an elementary text.

A carefully selected list of problems is given at the end of each chapter and it adds much to the value of the book as a text. On the whole we think this text to be as well suited for teaching purposes as any that has recently come to our attention.

J. H. Morecroft

Columbia University

The Life of the Plant. By C. A. Timiriazeff. Translated from the revised and corrected seventh Russian edition by Anna Chereme-teff. New York, Longmans, Green, and Co. 1912. Pp. 355 with 80 text-figures. $2.50.

It is a great pity that this admirable popular presentation of the status of plant physiology might not have appeared in English some twenty-five years ago. Originally published in 1878 and passing through seven editions it can not but strike one familiar with the current literature as being distinctly behind the times, in spite of the evident effort to incorporate various modern investigations. For the specialist the translation has been too long delayed, and even for the general reader there are many views which should be modified in order to give as accurate as possible a notion of what the plant really does. On the other hand, it must be confessed that Professor Timiriazeff has presented the subject in such an attractive form that its very readableness is a strong point in favor of the book. Few of those who have any interest in botany whatever but that will enjoy reading "The Life of the Plant" and the great number of apt illustrations and demonstrations makes one wish that numerous American audiences might have had the opportunity of listening to such a course of lectures thirty-five years ago. The popular conception of a botanist would certainly be higher.

The book is neither a text-book nor a special treatise, but a simple account of the more fundamental life processes of the plant told in a way calculated to make them interesting if not "popular." For this reason it is

hardly necessary to take it up page by page, as is so often done with volumes intended for students, and point out various slips, typographical and otherwise. The author disclaims any idea of expressing the whole truth, but feels the obligation of saying nothing but the truth. This limitation, not always felt by writers of popular works on botany, may be responsible for some of the omissions noted.

After a particularly good discussion of the relation of botanical science to society, one chapter each is devoted to the cell, the seed, the root, the leaf, the stem, growth, the flower, plants and animals and the origin of organic form. This latter chapter is distinctly pro-Darwin; in fact, there is little if any reference to the recent work along this line and the whole discussion smacks strongly of *Zweckmässigkeit*. The reason for adding as an appendix a lecture delivered in 1875 on the plant as a source of energy is not manifest. Unfortunately there is no index.

G. T. M.

The Toxicity of Caffein: an Experimental Study on Different Species of Animals. By WILLIAM SALANT and J. B. RIEGER. Bureau of Chemistry Bulletin 148, pp. 98.

The Elimination of Caffein: an Experimental Study on Herbivora and Carnivora. By WILLIAM SALANT and J. B. RIEGER. Bureau of Chemistry Bulletin 157, pp. 23.

One can not help feeling, on looking through these two bulletins filled with a wealth of detailed investigation on so important a drug as caffein, that the authors left no stone unturned in their quest for truth. So many experiments were made that their presentation in abstract form is extremely difficult. However, a few of the salient features can be briefly stated.

The principal object of the work describd in the first paper seems to be the determination of the toxic and of the fatal dose of caffein for the rabbit, guinea-pig, cat and dog. Theoretically this is simple. But as the authors have shown, the toxicity of caffein, like that of any other drug, depends upon such conditions as the age of the animal, its diet, the method of administering the drug, and still other factors which complicate the question of toxicity. Only after the most extensive investigation can all of the questions taken up in the bulletin be answered with any degree of certainty.

So strongly has the influence of diet, method of administration, etc., on the action of a drug been emphasized that one can not help wondering whether the toxic and fatal doses of caffein are really definite quantities for more than one set of experimental conditions. The conservatism of the authors, as exemplified in the following statement from page 91 of their bulletin, is certainly commendable: " . . . the most striking effect of caffein observed in the work herein reported was the comparatively wide range of variation in the resistance of individuals of the same species to this drug. This was found to be the case even when the conditions of experimentation were approximately uniform. . . ."

In their second bulletin the authors present their work on the elimination of caffein. They found that " Caffein administered subcutaneously, by mouth, or intravenously, is eliminated in part unchanged, in the urine, into the gastrointestinal canal, and into the bile. . . ."

Since the appearance of the above bulletins, at least two other pharmacological researches have been published which show how extremely careful the investigator must be before coming to final conclusions regarding the toxicity of a drug. In the *Proceedings of the Society for Experimental Biology and Medicine*[1] Kleiner and Meltzer describe some experiments on the reduction of the toxicity of strychnin by the simultaneous administration of large quantities of fluid. They state " that the toxicity of strychnin is definitely reduced not only when it is administered in great dilution, but also when saline or water is administered nearly simultaneously in other parts of the body, thus, perhaps, diluting the poison within the body. . . ."

Traube[2] states that the pharmacological ac-

[1] Vol. IX., p. 101, 1912.

[2] *Biochemische Ztschr.*, Bd. 42, p. 494, 1912.

tion of many alkaloids may be appreciably influenced by the presence of certain types of salts such as alkali carbonates.

Who knows but that the toxicity of caffein may be influenced by the mineral matter of the diet and by the quantity of water the animal drinks?

William N. Berg

Washington, D. C.

Catalogue of the Lepidoptera Phalænæ in the British Museum; Catalogue of the Noctuidæ in the Collection of the British Museum. By Sir George F. Hampson, Bart. Volume X., 1910, Volume XI., 1912. London (England).

The two volumes comprise 2,140 species, in the subfamilies Erastriinæ, Euteliinæ, Stictopterinæ, Sarrothripinæ and Acontiinæ. They are illustrated by two volumes of colored plates, Nos. CXLVIII. to CXIX., inclusive. There are also many cuts in the text illustrating typical species in each genus, giving both the general appearance and structural characters. Keys to the genera in each subfamily and to the species in each genus are given. There are also genealogical trees for each subfamily, showing the author's ideas of the evolution of the genera. The treatment is the same as in previous volumes of this work, which we have had occasion to notice. The genera are arranged upon adult structural characters, selected by the author. Resort has been had to many minor characters, such as modifications of the tuftings of the vestiture, tubercles on the front of the head, spines on the legs, etc. These characters are in many cases of little phylogenetic importance, so that the classification is to a large degree arbitrary and artificial. This appears distinctly in the arrangement of species within the genus also, where primary groups are made on modifications of antennal structure in one sex and other secondary sexual characters, so that really closely allied species are often widely separated. It would be rather difficult, however, to have avoided this and still keep the keys in a workable condition, especially where the vast majority of the early stages and life histories are unknown, as is the case with these insects. The nomenclature of the North American species included in the book is greatly changed from that familiar to us. This appears to be unavoidable, as the classifications of different authors based on restricted faunal regions are here combined. The names here established will probably tend to be permanent, as it will be long before any one attempts to treat the Noctuidæ of the world on new lines with material equal to that afforded by the British Museum.

The British Museum collection, rich as it is, does not make a practise of retaining long series of specimens of common species. Consequently the author of these catalogues occasionally suffers from lack of sufficient material. We notice in the genus *Iscadia* (vol. XI., p. 362) some errors due to this cause. The subfamily Sarrothripinæ, to which *Iscadia* is assigned, is defined by the presence of a bar-shaped retinaculum on the fore wing of the male. In *Iscadia aperta* Walker and *I. duckinfieldia* Schaus this is absent. Sir George notes its absence in *I. aperta,* but having only one male he supposes it may have been broken off. Furthermore, *I. aperta* has simple flattened antennæ in the male, not bipectinate, as given in the table. *I. duckinfieldia* is abundantly distinct from *I. aperta,* not possibly an aberration, as suggested, for it has pectinated antennæ in the male and differs in markings, the double black line above the reniform-mark being absent. The separation of *I. duckinfieldia* on the brown costal shade is ineffective, as this shade is as often absent as present. These imperfections would have been obviated by larger series of specimens of these rather common species.

Harrison G. Dyar

SPECIAL ARTICLES

THE NATURE OF THE FERTILIZATION MEMBRANE OF THE EGG OF THE SEA URCHIN (ARBACIA PUNCTULATA)

Many widely held hypotheses, *e. g.,* on the dynamics of cell division, etc., are based on

the nature of the fertilization membrane of the sea urchin egg. The methods which have been used heretofore in the study of this so-called membrane have been inadequate to determine its exact nature. The writer has made some observations, by the use of methods which are apparently new to this field, which seem to throw a new light on the structure of the various coatings on this egg. As is well known, there has been no agreement among cytologists concerning the number and nature of the coverings of this egg. A few investigators have recognized the presence of a thick jelly surrounding the egg, but have given us no methods of demonstrating its true extent or nature. Further, no one has used methods by which the physical characteristics of the vitelline membrane could be determined in the living egg, and the relation of this membrane to the cytoplasm on the one hand and to the egg-jelly on the other.

The normal unfertilized egg is covered by a soft invisible jelly about 23 microns in thickness. Beneath this and closely stuck to the surface of the cytoplasm is a tough somewhat elastic vitelline membrane. Morphologically, this latter is the only membrane on the egg of *Arbacia*. It is literally glued to the outer surface of the cytoplasm. The average of a number of measurements shows that the vitelline membrane is about 1.9 microns in thickness. In the living egg the inner part of this structure is seen as a light line on the outer surface of the cytoplasm when the light is sufficiently stopped down. The refractive index of the outer part is so nearly that of sea water that this portion is invisible.

In the reaction of the egg to the spermatozoon, striking morphological changes occur in the vitelline membrane and the surface of the cytoplasm. The change in form of the egg-jelly is slight. About one and one half minutes after active spermatozoa are mixed with the eggs, a definite swelling of the vitelline membrane occurs. The extent and location of the swelling varies greatly in different eggs. In some eggs the swelling is complete in one minute, but three to five minutes are usually required for the maximum swelling of this structure. During the swelling of the vitelline membrane its refractive index is so changed that it usually becomes distinctly visible by the usual microscopical examination. When swelling is complete the thickest portion of this structure frequently measures as much as nine microns. About six minutes after insemination of the eggs the surface of the cytoplasm swells and changes its refractive index. In one minute the swelling is complete and measures about one micron in thickness. This is the well-known hyaline plasma-layer. By the time the swelling of the vitelline membrane has become well advanced, a change occurs in the refractive index of the inner part of the egg-jelly and this becomes visible. As seen by the usual microscopical examination the so-called fertilization membrane of the egg of *Arbacia* consists of three parts, viz., the inner part of the egg-jelly which has undergone a change in its refractive index, the swollen vitelline membrane and the thin highly refractive surface layer of the cytoplasm. This hyaline layer is still very adherent to the vitelline membrane. The edematous vitelline membrane is softer and more elastic than it is in the unfertilized egg. If this structure is partially dissected from the fertilized egg it frequently contracts to a glutinous mass on one side of the cytoplasm. The relation of the hyaline plasma-layer to the vitelline membrane and the cytoplasm is brought out very clearly in fertilized eggs which have been plasmolyzed by adding cane sugar to sea water. The protoplasm shrinks and the hyaline layer frequently takes on the appearance of pseudopodial-like processes of the cytoplasm. When the vitelline membrane is dissected from the egg, the hyaline layer remains as an organic part of the cytoplasm. These methods leave no doubt as to the nature of this structure; it is the swollen surface of the cytoplasm and enters into the formation of the larval sea urchin. The water-holding power of the hyaline layer and of the edematous vitelline membrane is striking. These structures do not show an appreciable shrinkage in quite concentrated solutions of cane sugar in sea water.

Three methods have been used singly and in various combinations in this study. By the plasmolytic method a separation of the hyaline plasma-layer from the vitelline membrane is easily affected. Vital staining differentiates clearly the various structures on the surface of the egg. Janus Green (dimethylsafraninazodimethylanalin) in dilute solutions stains the egg-jelly light blue. It is also beautifully demonstrated by a number of other vital stains. In concentrated solutions of janus green the jelly shrinks to a mere hull. Slightly concentrated solutions of isamin blue, dissolved in sea water by boiling, stain the swollen vitelline membrane a deep blue while the hyaline layer is much lighter in color. Toluidin blue stains the hyaline layer of the cytoplasm and the vitelline membrane, but as a differential stain it does not equal isamin blue.

The removal of the egg-jelly and vitelline membrane from the fertilized and unfertilized eggs was affected by dissection with glass needles made from very hard Jena glass tubing about 5 mm. in diameter. The points on many of these needles measured less than one half micron. The needles were held in a Barber pipette-holder and the dissections made under a magnification of five hundred and sixty-two diameters.

It seems that the type of reaction described for the egg of *Arbacia* is a somewhat common one, since essentially the same changes occur in the eggs of *Chætopterus* and the mollusk *Cumingia*. In these two forms the maximum swelling of the vitelline membrane does not occur until about twenty to thirty minutes after insemination of the eggs.

An analysis of the reaction of the egg of *Arbacia* to the spermatozoon has been attempted. Puncture of the vitelline membrane has failed to produce the reaction. Doses of from one to five spermatozoa have been injected into the egg-jelly and the relation between the time required for the penetration of the vitelline membrane by the spermatozoon and the extent and location of the swelling of this structure have been studied. By injecting spermatozoa into the egg-jelly, in a small percentage of cases a single spermatozoon becomes attached to the vitelline membrane and produces the reaction that has been described. The passage of the spermatozoon through the vitelline membrane has been observed in a number of eggs. It has been found possible to remove the spermatozoon from the vitelline membrane after it has caused the reaction. The real difficulty in this type of experiment is not the size of the spermatozoon, but the fact that when even four or five spermatozoa are injected into the egg-jelly they usually swim out and away from the egg. This necessitates the making of many injections in order to get a single spermatozoon to attach itself to the vitelline membrane and start the reaction.

As far as my evidence goes at the present time it seems that the primary function of the much discussed reaction of the egg of *Arbacia* to the spermatozoon is the prevention of polyspermy.

The details of this study will appear later.

G. L. Kite

The Marine Biological Laboratory,
Woods Hole, Mass.,
September 7, 1912

A SIMPLE METHOD OF MAKING ARTIFICIAL CELLS RESEMBLING SEA URCHIN EGGS IN CERTAIN OF THEIR PHYSICAL PROPERTIES

Several years ago Robertson showed that if chloroform was shaken with egg-albumen solution, the droplets would not reunite even when washed in water, because of the formation of a proteid film on the chloroform surface. It can be readily observed that such droplets shrink in volume, owing to the passage of chloroform into the water outside.

While studying the penetration of alkalies into lecithin in various solvents, I noticed that if lecithin is dissolved in chloroform and the solution shaken with proteid solutions, the chloroform of the resultant globules is in time completely replaced by water. Eventually, then, instead of lecithin in chloroform, we may obtain small cells of lecithin in water sur-

rounded by a fine proteid membrane. This membrane is impermeable to lecithin.

During the exchange of water for chloroform a characteristic structure appears in the droplet. It is at first clear but within 30 seconds becomes filled with a dense mass of granules (probably water) so that it looks white against a dark background. The droplet is still mostly chloroform, as may be determined by pricking it with a needle. The contents do not mix with the water.

In the course of an hour, the dense granular structure disappears and the drop clears. There remain only a few dense granules (probably some form of lecithin) mostly aggregated together to form an excentric knot like a karyosome. It is in this stage, which is stable and persists until destroyed by bacteria, that the resemblances to sea urchin eggs are most marked.

If pricked with a needle the contents flow slowly out as a viscid protoplasm-like mass and mix (except the granules) with the water. No chloroform is now present.

The cells are not rigidly spherical in shape, as oil globules suspended in water, but present exactly those slight irregularities which may be observed in freshly laid sea urchin eggs.

The surface film is similar to the surface membrane of a sea urchin egg in appearance and also in consistency, as indicated by its resistance to pricking and to pressure.

Neutral red is accumulated from dilute solution by the cell as a whole but in particular by the granules, which stain very deeply.

Such red stained cells are turned yellow at the same rate by $n/2{,}000$ NaOH and $n/2{,}000$ NH_4OH. In regard to their permeability relations they therefore differ markedly from marine eggs, which are entered much more rapidly by NH_4OH. They possess also no polarity except one attributable to gravity.

These artificial lecithin cells resemble egg cells in one more important and striking respect. If a trace of saponin is added to the sea water in which sea urchin eggs lie, the eggs almost instantly swell and the contents become more fluid and clear, *i. e.*, the eggs cytolyze. Exactly the same thing happens when a trace of saponin is added to water containing lecithin cells. They swell and become clear spheres with only a few granules in the interior. The similarity is indeed perfect.

Future work may indicate methods by which protein can be obtained within a lecithin membrane, the whole of a size comparable with cell size, or can be introduced into lecithin cells. Such cells promise to exhibit even more striking and interesting properties than those herein described.

E. NEWTON HARVEY

WOODS HOLE, MASS.,
September 6, 1912

A METHOD OF DETERMINING THE AVERAGE LENGTH OF LIFE OF FARM EQUIPMENT

IN determining the cost of farm operations one of the most difficult items to determine accurately is the rate of depreciation of farm equipment. Recently Mr. H. H. Mowry, of the Office of Farm Management, who has collected extensive data on the problem of depreciation of farm equipment, suggested to the writer the possibility of determining the average length of life of a farm implement from data relating to the number of years each implement has been used. Apparently a solution for this problem has been found. The solution applies to all objects, either animate or inanimate, lasting for varying lengths of time.

Two cases are to be considered, namely, (1) when the number of the objects under consideration is approximately constant from year to year, and (2) when their number is increasing or decreasing. The first case may be conveniently considered in its application to farm dwellings. Suppose that on a given group of farms there is a definite number of farm dwellings of various ages, and that as fast as old dwellings become unsuited to their purpose they are replaced by new ones. For convenience of reference let us reduce the numbers with which we have to deal to symbols. Let N_1 represent the number of dwellings in their first year of life, N_2 the number in their second year, N_3 the number in their third year, and so on, N_n representing the

number of dwellings of the oldest age represented in the group.

In any group of objects which last for varying lengths of time but in which the number of objects is kept constant by replacing discarded ones by new ones the following principles apply:

1. The number of old objects discarded each year is, on the average, equal to the number of new ones introduced.

2. The average number of objects in the second year of their life at a given time is equal to the average number of those in their first year that will live to enter their second year. The average number in their third year is on the average equal to the number of those in their first year that will live to enter their third year, and so on. In general, the number of objects in their nth year is equal to the number of those in their first year that will live to enter their nth year.

3. Hence N_2, N_3, etc., which represent the number of objects now in their second, third, etc., years of life, may also be taken to represent the number of the objects now in their first year that will ultimately reach their second, third, etc., years of life.

4. If now we add together N_1, N_2, N_3, etc., this is equivalent to counting each object now in its first year as many times as it will live years. Hence the sum of N_1, N_2, N_3, etc., which represents the total number of objects of all ages, also represents the sum of the ages that will be attained by all the objects now in their first year.

5. Therefore, if we divide the total number of objects of all ages in the group by the average number in their first year the quotient will be the average length of life that those now in their first year will live. But since the average number of objects in their first year is the same from year to year, this average is a general one and applies to the whole population. We may thus express the average length of life of any constant population by means of the following formula:

$$L = \frac{N_1 + N_2 + N_3 + \cdots + N_n}{N_1}. \qquad (A)$$

This formula may be expressed more simply by writing for the numerator simply the total population instead of the sum of individuals of different ages. We thus have

$$L = \frac{P}{N_1}. \qquad (B)$$

In this formula L equals the average length of life, P the total population, and N_1 the average number in their first year of life at a given time.

In applying either of the above formulæ to cases like those of farm houses and most kinds of farm implements the fact that very few such objects are discarded until they are at least four or five years old makes N_1, N_2, N_3, N_4 and N_5 approximately equal. That is, the number of objects one year old is about the same as the number two years old, or three years, etc., up to about five years, and sometimes even longer. In making a study of such objects with a view to determining the average length of their life it is usually possible to get quite accurately the number of objects in the group in each year of life up to five or six years of age, and where these numbers are about the same for each year their averages will represent quite accurately the average number of new objects introduced in a year, which is the same as the average number of old ones discarded. Hence, in populations where the number of objects in each of the earlier years of life is approximately the same, the average length of life in the population may be obtained by dividing the total number of objects by the average number in each of the early years of life.

POPULATIONS THAT ARE DECREASING OR INCREASING

The principles stated above do not apply in a population that does not remain constant from year to year. It is not difficult, however, to work out a formula based on formula (A) above that does apply to such populations. This may be done as follows:

Suppose the rate of increase in population is 1 per cent. a year. Then if P represents the population in any one year, $1.01P$ will repre-

sent the population the next year. Likewise, if B represents the number of births in any year, then $1.01B$ will represent the number the next year. In general, if B represents the number of births in any year and r the annual rate of increase in population, then $(1+r)B$ will represent the number of births the first year thereafter, $(1+r)^2B$ the number of births the second year thereafter, and $(1+r)^nB$ the number of births the nth year thereafter.

Returning now to formula (A), where N_1 represents the number of individuals in the first year of life, N_2 the number in their second year, and so on, we have already seen that in a constant population these numbers bear such relation to each other that N_2 represents the number of the present N_1's that will live to enter their second year. But in an increasing population this is not the case, for the number of individuals born in the year in which the present N_2's were born was smaller than the number born in the year in which the present N_1's were born—that is, the number born last year is smaller than the number born this year. Hence, in an increasing population N_2 is smaller than the number of N_1's that will live to enter their second year. But if we increase N_2 in proportion as the number born this year is greater than the number born last year, this increased value of N_2 will represent the number of the present N_1's that will live to enter their second year.

If we let B stand for the number born in the year in which the present N_2's were born, then $(1+r)B$ will represent the number born the year the present N_1's were born, which of course is just one year later. The increased value of N_2, for which we are seeking, may now be found from the proportion

$$B : (1+r)B :: N_2 : X,$$

from which

$$X = (1+r)N_2.$$

In similar manner it can be shown that if we substitute for N_3 the expression $(1+r)^2N_3$ this new value will represent the number of present N_1's that will live to enter their third year, and so on for all of the various N's in the numerator of formula (A). This gives us

$$L = \frac{N_1 + (1+r)N_2 + (1+r)^2N_3 + \cdots + (1+r)^{n-1}N_n}{N_1}. \quad (C)$$

In this new formula the terms of the numerator represent, respectively, the number of the present N_1's that will live to enter the various years of life indicated by the subscripts after the N's. Hence the sum of the terms of the numerator is equal to the sum of the ages the present N_1's will reach at death, and the value of the whole fraction becomes the average length of life of the population.

To use formula (C), which applies to populations that are increasing or decreasing at a constant rate, r, we must know the number of individuals in each of the various years of life at the present time and the annual rate of increase or decrease in population. Such data are usually not available except in the cases of human beings in restricted areas where births and deaths are accurately recorded. In some cases, however, it may be possible to obtain data of this kind concerning a class of articles of farm equipment. When this is possible, the average length of life may be calculated where the number of objects is increasing or decreasing at a constant rate per year.

It will be noticed that when r is equal to zero, which it is in a constant population, formula (C) becomes identical with formula (A).

Formula (C) applies only to populations in which the *rate* of increase or decrease is the same from year to year. It is possible to develop another formula for the average length of life which is independent of the rate of increase and which therefore applies to any kind of population, no matter what the rate of increase or decrease, and whether this rate is the same from year to year or not.

Let B_2 represent the number of individuals born the year the present N_2 individuals were born, and B_1 the number born the present year. Then the proportion $B_2 : B_1 :: N_2 : X$, in which X is equal to $(B_1/B_2)N_2$, gives a value which if used instead of N_2 makes the third term of the numerator of formula (A) represent the

number of the present N_1's who will live to enter their third year. The other terms of the numerator of formula (A) may be modified in similar manner, giving the formula

$$L = \frac{N_1 + \frac{B_1}{B_2} N_2 + \frac{B_1}{B_2} + N_3 \cdots + \frac{B_1}{B_n} N_n}{N_1}, \quad (D)$$

which is applicable to all populations for which we have the following data: the number of individuals born each year since and including the year in which the oldest individuals now living were born, and the number of people of various ages now living.

While formula (D) has very wide applicability, its usefulness is greatly limited by the fact that it requires so large an amount of data which is usually difficult to obtain.

Before applying any of these formulæ it is necessary to eliminate the effect of immigration and emigration. This means that only those individuals should be considered whose whole life is to be spent as a part of the population under consideration. In using any of the methods here presented in determining the average rate of depreciation of, say, a farm implement of a given kind, only those implements are to be counted that were bought new (not second hand) and which will presumably be replaced when destroyed or worn out by new ones.

W. J. Spillman

Washington, D. C.

Quarter Centennial of the Iowa Academy of Science

On Friday and Saturday, April 26–27, the Iowa Academy of Science celebrated the twenty-fifth anniversary of its organization. The sessions were held in the Art Gallery of the State Historical Building in Des Moines, beginning at 1:30 Friday afternoon. The president's address was given by Professor Louis Begeman, of the State Teachers College, on "The Mission and Spirit of the Pure Scientist." After the president's address the reading of the usual scientific papers as presented before the academy was the order of the afternoon. As forty-six titles were presented, it was necessary that the time allotted to each paper be very brief.

The anniversary banquet was held Friday evening at the Chamberlain Hotel, with an attendance of seventy. At the close of the banquet short addresses of congratulation were given by representatives of neighboring scientific societies. The Nebraska Academy of Science was represented by Professor Addison E. Sheldon, the Illinois Academy of Science by Professor Henry B. Ward, the Davenport Academy by Professor C. C. Nutting, the St. Louis Academy by Professor L. H. Pammel, the American Microscopical Society by Professors H. E. Summers and L. S. Ross and the Ohio Academy by Professor Herbert Osborn. An address on the "Charter Members" was given by Professor L. H. Pammel and the anniversary address by Professor Herbert Osborn, of the State University of Ohio, the first president of the Iowa Academy.

In accordance with the purpose of the anniversary meeting, the session Saturday forenoon was devoted to addresses on "The Development of the Sciences in Iowa during the Past Twenty-five Years":

Botany—Professor Thomas H. Macbride.
Chemistry—Professor W. S. Hendrixson.
Geology—Professor M. F. Arey.
Physics—Professor Frank F. Almy.
Zoology—Professor C. C. Nutting.

These papers gave valuable reviews of the status of the sciences in the colleges at the time of the organization of the academy, and historical sketches indicating marked advance in all scientific lines during the quarter century.

At the business meeting, over eighty applications for membership were presented. The meeting was in every way fitting to celebrate the end of a quarter century of earnest and effective work done by the academy.

The 1913 meeting will be held at the Iowa State College, Ames.

Titles of Papers Presented

(Abstracts furnished by authors)

Ferns and Liverworts of Grinnell and Vicinity: H. S. Conard.

Secotium warnei, a Stalked Puffball: H. S. Conard.

Simblum rubescens in Iowa: H. S. Conard.

Aroid Notes: James Ellis Gow.

In studying the morphology of some twenty species of Aroids, mostly tropical, the writer found that there is great confusion in the nomenclature of the species. A reference to the original sources has made it possible to give a correct account of the taxonomy of all but one species, and the results are here presented.

Behavior of Pollen Tubes in Richardia Africana: James Ellis Gow.

An Anomalous Ovary: James Ellis Gow.

The Late Blight of Barley—Helminthosporium teres Sacc.: A. L. Bakke.

Some Points on the Floral Development of Red Clover (Trifolium pratense): J. N. Martin. Introduced by L. H. Pammel.

Native Dye-plants and Tan-plants of Iowa with Notes on a Few Other Species: Harriette S. Kellogg.

The Genus Lycoperdon as Represented in the Herbarium of the State University of Iowa: N. D. Knupp.

Notes on Heteranthera dubia: R. B. Wylie.

Notes on Some Parasitic Fungi Chiefly from the Bitter Root Mountains: L. H. Pammel and Ella Grace Harvey.

The Effect of Continued Grinding on the Water of Crystallization (second paper): Nicholas Knight.

The Dynamics of the Reaction between Ethyl Iodide and Silver Nitrate in Ethyl and Methyl Alcohol and in Mixtures of these Solvents: O. M. Weigle and J. N. Pearce.

The Solubility of Lead Sulphate in Aqueous Solutions of Sulphuric Acid: P. A. Jans and J. N. Pearce.

The First Reported American Lepidostrobus is from Warren County, Iowa: John L. Tilton.

The paper records the discovery of the specimen, the conditions under which it had been preserved and evidences that in other places may lead to the discovery of specimens of equal interest. It was illustrated by the specimen itself and by lantern slides of prepared sections.

Nether Delimitation of our Carbonic Rocks: Charles R. Keyes.

Singularly enough the base of the Carbonic rocks in Iowa has never been definitely recognized; neither has the top of the Devonic sequence. The present paper records the facts recently discovered which go to show that there is a marked unconformity between the two great formations. This basal terrane of the Carbonic strata is the Grassy black shale of Missouri, which has always been regarded as of Devonic age. Its northern continuation proves to be the Sweetland shale of Muscatine County.

Arid Plateau Plains as Features of Eolic Erosion: Charles R. Keyes.

One of the great difficulties in the consideration of eolic erosion has been the securing of quantitative data, and direct proofs that supposable examples are not possibly the results of stream-corrasion. These proofs are believed to be found in the lava-capped mesas of excessively dry regions.

Sundry Provincial and Local Phases of the General Geologic Section of Iowa: Charles R. Keyes.

Certain features of the stratigraphy of the state are briefly discussed in the light of recent advances in geologic classification. The present need appears to be a careful revision of the nomenclature of the geologic formations now recognized and a detailed study of certain of the larger groups with a view to properly subdividing them.

The Salem Limestone and its Stratigraphic Relations in Southeastern Iowa: Francis M. Van Tuyl.

Recent stratigraphic studies have suggested that a limestone member formerly regarded as the basal portion of the St. Louis is distinctly formational in character and is of the horizon of the Salem limestone of Illinois and Indiana. Unconformities occur both at the base and at the top of the formation.

The Origin of the Geodes of the Keokuk Beds: Francis M. Van Tuyl.

Previous theories of the origin of the geodes are briefly discussed and evidence is presented to show that these theories are untenable. The presence in the beds at some localities of calcareous nodules grading into geodes suggests a method of geodization not previously recognized.

A Study in the Cherts of the Osage Series of the Mississippian System: Francis M. Van Tuyl.

Cherty nodules and bands are prominent features of the Burlington and Keokuk limestone members of this series. Excellent facilities for studying the chert were recently afforded in the power-plant excavation at Keokuk. In the discussion of the origin of the material it is concluded that it has resulted from the metasomatic replacement of the limestone.

A Method of Teaching Elementary Mineralogy: G. F. Kay.

A Survey of the Water-bearing Gravels at Estherville, Emmet County, Iowa: G. G. Wheat.

Additional Evidence of Unconformity between the Cedar Valley and Lime Creek Stages of the Devonian of Iowa: A. O. Thomas.

The type outcrop showing unconformity is described; several similar outcrops are noted. A

new substage, tentatively called the Floyd limestone, is added at the base of the Lime Creek stage.

Some Notes on the Aftonian Mammals: A. O. Thomas.

A number of interesting mammalian bones and teeth have been added to the State University collection during the past year. They are chiefly remains of the elephant, horse and camel. The finding of the lower jaw of a beaver adds a new genus to this remarkable faunal assemblage.

Early Iowa Locality Records: B. Shimek.

A discussion of the early Iowa plant, mollusk and insect records in the earlier reports, such as those of the Lewis and Clark, Long, Nicollet and Owen expeditions. Also a discussion of the "Council Bluff," Nebraska, records which are sometimes thought to refer to Council Bluffs, Iowa.

The Phase Difference at the Ears Produced by a Simple Source of Sound: G. W. Stewart.

A New Laboratory Apparatus for Measuring Time, Independent of Clock or Chronograph: F. C. Brown.

Evidence Favoring the Chemical Disintegration of Sodium as an Element: F. C. Brown.

The Effect of Mechanical Rupture on the Electrical Conductivity of Selenium: F. C. Brown.

A Method of Determining Whether the Restoring Torque is Proportional to the Torsional Strain during the Vibration of a Torsional Pendulum: L. P. Sieg.

The Influence of an Electric Current upon the Elasticity of Wires: H. L. Dodge.

A Simple Laboratory Equipment for the Elementary Study of Alternating Currents: H. L. Dodge.

On the Dissimilarity of Light and Heat Action in a Certain Variety of Selenium: E. O. Dieterich.

Mollusca of Iowa: T. Van Hyning.

A Study in Insect Parasitism: R. L. Webster.

An account of certain insect parasites reared from the common tomato-worm, *Phlegethontias sexta* Johanssen, the relations of these parasites to the host and to each other, and their comparative abundance, etc.

A Systematic Study of the Reduviidæ of North America: S. B. Fracker.

Notes on a Collection of Mammals from Northwestern Iowa: Alexander G. Ruthven and Norman A. Wood.

Contributions to the Herpetology of Iowa—II.: Alexander G. Ruthven.

Food Habits of Red-tailed Hawk, Cooper's Hawk and Sparrow Hawk: F. C. Pellett.

The Interpretation of the Cardio-sphygmogram and the Electro-cardiogram, Normal and Pathological: W. E. Sanders.

The Source of the Chromaffine Cells in the Guinea-pig: Mildred R. Yule.

Notes on the Food of the Black-crowned Night Heron in Captivity: B. H. Bailey.

The Occurrence of Melanism in the Broad-winged Hawk: B. H. Bailey.

A Remarkable Flight of Broad-winged Hawks: B. H. Bailey.

L. S. Ross,
Secretary

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY, UNIVERSITY OF VIRGINIA. MATHEMATICAL AND SCIENTIFIC SECTION

The first meeting of the session 1912–13 of the Mathematical and Scientific Section was held September 23, 8:00 P.M. The following officers were elected:

Chairman—Professor Llewelyn G. Hoxton.

Secretary—Profesor Wm. A. Kepner.

Publication Committee—Professors W. H. Echols, J. L. Newcomb and Thomas L. Watson.

The retiring chairman, Professor Thomas L. Watson, read by title a paper on "Kragerite, a Rutile-bearing Rock from Krageros, Norway." Professor Watson read a second paper entitled "Vanadium and Chromium in Rutile and the Possible Effect of Vanadium on Color."

Professor R. M. Bird reported observations made along New River, Virginia to North Carolina.

Wm. A. Kepner,
Secretary

University of Virginia

THE ELISHA MITCHELL SCIENTIFIC SOCIETY

The 200th meeting of the society was held October 15 in Chemistry Hall, University of North Carolina, Professor E. V. Howell presiding. The following new members were elected: Professor H. W. Chase and Mr. J. S. Holmes. The following papers were read:

"Chemical Control of Industrial Plants," by Dr. C. H. Herty.

"The Water Molds of Chapel Hill," by Dr. W. C. Coker.

James M. Bell,
Recording Secretary

Chapel Hill, N. C.